

**Status Review for the
Columbia Spotted Frog
(*Rana luteiventris*)
on the Wasatch Front, Utah**

**United States Department of the Interior
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EXECUTIVE SUMMARY

a. Summary of Content

We have compiled and analyzed to the extent possible the most recent and best scientific and commercial data available on the spotted frog to complete this status review. This information included published and unpublished reports, manuscripts, books and data, memoranda, letters, phone communications, email correspondence, and information gathered at meetings. In addition, persons who were species experts on the spotted frog were provided opportunity to comment on the data used in this report to ensure it was the most accurate and updated information available and that it was interpreted accurately.

Based on this analysis, the overall status of the spotted frog on the Wasatch Front declined over the last century until the early 1990s. Although a paucity of data makes it difficult to define how many spotted frog populations there were historically, anecdotal and available survey information indicates that this species was probably the most historically abundant frog on the Wasatch Front. Historical declines in the Wasatch Front spotted frog population were attributed to wetlands loss resulting from agriculture, livestock grazing, urbanization, and water development. Introduction of nonnative predators and the cumulative effects of urban and agricultural contaminants also may have reduced the suitability of remaining habitats; although the specific and long-term effects of these issues are still unknown. Impacts from these threats were speculated to have caused the extinction of the Wasatch Front spotted frog by the 1980s.

Survey efforts in the early 1990s resulted in the discovery of nine spotted frog populations. Concern for the spotted frog escalated and conservation efforts began to receive funding and support, including the interagency Spotted Frog Conservation Agreement and Strategy which was signed in 1998; there were six extant populations on the Wasatch Front at this time. These actions were successful at addressing some localized threats to the species through on-site management activities. In addition, funds were allocated for research into the life history, habitat requirements, and genetics of the spotted frog.

Seven populations of spotted frogs are currently known to exist in the Wasatch Front DPS--Mona Springs/Burraston Ponds, Springville Hatchery/T-Bone Bottom, Holladay Springs, Jordanelle/Francis, Heber Valley, Fairview, and the recently discovered Vernon population. Although threats, including urbanization, water development, agriculture, and livestock grazing practices remain, conservation actions ongoing and completed since 1998 have significantly improved the long-term viability of the species.

b. Status Review Team

This status review was performed by Jessica Gourley, Laura Romin, and Yvette Converse, with mapping and GIS assistance from Diana Whittington, of U.S. Fish and Wildlife Service, Utah Field Office.

c. Acknowledgments

The Service would like to acknowledge the following agencies and institutions for providing information on the background, status, and conservation activities for spotted frog for this status review: Utah Division of Wildlife Resources, Utah Reclamation Mitigation and Conservation Commission, Utah Bureau of Land Management, U.S. Forest Service, Central Utah Water Conservancy District, U.S. Bureau of Reclamation, U.S. Forest Service, Brigham Young University, and the University of Nevada. Many of the regional and local biologists, managers and interested professionals have provided information for and reviewed portions of this document in draft.

II. GLOSSARY OF TERMS AND ABBREVIATIONS

The following terms and abbreviations are used throughout this document:

a. Agencies and Institutions

BLM	U.S. Bureau of Land Management
CUWCD	Central Utah Water Conservancy District
Goshute Tribe	Confederated Tribes of the Goshute Reservation
NPS	National Park Service
Service	U.S. Fish and Wildlife Service
UDWR	Utah Division of Wildlife Resources
USBR	U.S. Bureau of Reclamation
USFS	U.S. Forest Service
URMCC	Utah Reclamation Mitigation and Conservation Commission

b. Species

Spotted frog	Columbia spotted frog
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c. Terms

Agreement	Conservation Agreement
Act	Endangered Species Act of 1973, as amended
GMU	Geographic Management Unit

d. Abbreviations

ac	acre(s)
cfs	cubic feet per second
ft	feet
ha	hectare(s)
km	kilometer(s)
m	meter(s)
mi	mile(s)
mm	millimeter(s)

e. Definitions

These definitions are intended for the purposes of this status review and may or may not reflect definitions used elsewhere.

Conservation Action - Any activity that results in better information, improved conditions or perceivable benefits to the long-term protection, conservation and persistence of spotted frog.

Distinct Population Segment - A discrete portion of a species range that is significant to the remainder of the species to which it belongs (61 FR 4722, February 7, 1996). Discreteness may be defined by a marked separation based on physical, physiological, ecological, or behavioral characteristics. Separation may be supported by quantitative measures of genetic or morphological differences. Significance may be defined by criteria including, but not limited to - (1) the existence of the species in an unique ecological setting, (2) loss of the species would result in a significant gap in the range of the species, or (3) evidence of genetic distinctiveness.

Metapopulation - A collection of localized populations that is physically and genetically interconnected through the natural movement and successful reproduction of an occasional migrant from one population into a neighboring population. Because genetic interchange is difficult to document, for purposes of this document, a metapopulation refers to more than one population between which there is no physical barrier to movement. Connected populations not only provide genetic interchange but also provide demographic redundancy. Individuals from one population are capable of recolonizing or supplementing numbers in a connected population if environmental impacts or catastrophic events suppress numbers or eliminate a population.

Nonnative - A species that is present outside of its native range.

Population - A geographically, genetically or ecologically distinct group of frogs that regularly and freely intermix resulting in successful reproduction and recruitment of young frogs to new generations (see "Status Summary" for further criteria).

III. INTRODUCTION

a. Purpose of the Status Review

The purpose of this status review is to assemble the best available scientific or commercial data on the status of the Wasatch Front Distinct Population Segment (DPS) of the Columbia spotted frog (*Rana luteiventris*; spotted frog). Although the spotted frog is distributed throughout the eastern and southwestern portions of the Bonneville Basin in Utah, this status review is specific to those populations located in the Wasatch Front DPS (Figure 1). The U.S. Fish and Wildlife Service (Service) will use this status review to determine if the Wasatch Front spotted frog is warranted for Federal listing as threatened or endangered under the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 et seq.). Information relating to the spotted frog was solicited from the public and from local, State, and Federal agencies for this review, including:

- population status and trends
- threats to the species
- management policies and conservation plans and actions

b. Endangered Species Act Requirements

This section describes how the Act, and Service policy and guidelines, are used to assemble and evaluate this information. To evaluate the merit of this review, it is important to understand the intent of the Act, why species are listed under the Act, and what definitions and criteria are used to make determinations on the status of a species.

b.i. Listing Regulations and Guidelines

Section 4 of the Act and implementing regulations (50 CFR 424) describe the process whereby a species, subspecies, or population segments thereof, can be added to the list of threatened and endangered species. The Act allows any interested person, under section 553 (e) of Title 5, United States Code, to petition the Service to add a species, or remove a species from, the list of threatened and endangered species. The Service shall make a finding within 90 days of receiving a petition, to the maximum extent practicable, whether the petition presents substantial scientific or commercial information indicating the petitioned action may be warranted. This finding is based on all information available to the Service at the time the finding is made.

If a petition is found to be not substantial, notification is made to the petitioners and the process ends. If a petition presents substantial information, the Service shall promptly commence a status review of the species. The Service shall issue a 12-month finding on whether the petitioned action is warranted, not warranted, or warranted but precluded by other higher priority listing actions. If the action is warranted, the finding may be published in the form of a proposed rule. The Service would then have 1 year to finalize the listing action for the species.

A species also may be added to the list of endangered and threatened species when the Service, recognizing that a species is imperiled, places it the candidate list. By doing so, the Service is recognizing that the species warrants listing, but that an immediate listing is precluded by higher priority listing actions. When the listing of a candidate species is no longer precluded by other actions, the Service completes a proposed rule to list the species, followed within 1 year, by a final rule.

The final way that a species may be added to the endangered and threatened species list is by an emergency listing. Species are considered for emergency listing when the immediacy of a threat is so great to a significant proportion of the total population that the routine listing process is not sufficient to prevent large losses that may result in extinction. An emergency rule may be published at any time. Upon publication, the rule becomes effective immediately and is applicable for a period of 240 days. This affords the species the protections of the Act while the normal rule-making procedures are followed. A proposed rule to list the species followed by a final rule must be completed within the 240 day time-frame or the provisions of the emergency rule expire.

According to the Act and implementing regulations (40 CFR 424.11), a species shall be listed or reclassified, if, based on the best scientific or commercial data available, and after conducting a review of the species status, the species is found to be endangered or threatened because of any one or a combination of the following factors:

- A. The present or threatened destruction, modification, or curtailment of its habitat or range;
- B. Overutilization for commercial, recreational, scientific, or educational purposes;
- C. Disease or predation;
- D. The inadequacy of existing regulatory mechanisms;
- E. Other natural or manmade factors affecting its continued existence.

An endangered species is defined as any species which is in danger of extinction throughout all or a significant portion of its range. A threatened species is defined as any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range. Because no two species possess identical ecology and life history, and the response by a species to the above factors vary, the effect of the threat posed by the above factors also varies by species. This necessitates that the overall assessment in determining endangered or threatened status remain species-specific.

Guidance has been developed to assist the Service in making a listing determination. To evaluate the status of a species, section 4(b)(1)(A) of the Act requires that the Service take into account those efforts, if any, being made by any State or foreign nation, or any political subdivision of a State or foreign nation, to protect such species. The Service, as provided by policy (59 FR 34270), requires independent peer review of any pertinent scientific or commercial data and assumptions relating to the taxonomy, population models, and supportive biological and ecological information for species under consideration for listing. To ensure that any information used by the Service to support a listing activity is reliable, credible, and

represents the best scientific and commercial information available, biologists are required, by policy (59 FR 34271), to gather, impartially evaluate, and document their evaluation of all scientific and other information. Policy (59 FR 34270) also requires the Service to use the expertise of and solicit information from State wildlife agencies in preparing proposed and final listing rules.

c. Limitations of the Status Review

Due to a lack of scientific data, it is impossible to predict the exact historical status and distribution of the spotted frog along the Wasatch Front. Analysis of the historical distribution of the spotted frog is based on available anecdotal and scant survey information. The spotted frog is assumed to have occupied most suitable habitats throughout the region. The Utah Division of Wildlife Resources (UDWR) maintains ongoing efforts to obtain presence, status, and ecology information for spotted frog suitable habitats. However, this analysis is not comprehensive or complete throughout the range of the spotted frog and must be updated regularly to remain accurate. This is especially important for amphibian species such as the spotted frog which have highly cyclic population dynamics. Furthermore, it is virtually impossible to survey all potential habitats comprehensively, given funding and personnel resources. Therefore, this status review is limited to known populations of spotted frogs and known habitat conditions.

d. Chronology of Federal Activity on the Spotted Frog

1989	Board of Directors of the Utah Nature Study Society Petitions the Service to Add the Spotted Frog to the List of Threatened and Endangered Species.
1989	54 FR 42529 Notice 90-day Petition Finding, Substantial.
1993	58 FR 27260 Notice 1-year Petition Finding, Warranted but Precluded.
1994	59 FR 58982 Notice Candidate Notice of Review.
1996	61 FR 7595 Notice Candidate Notice of Review.
1997	62 FR 49397 Notice Recycled Petitions.
1997	62 FR 49397 Notice Candidate Notice of Review.
1997	62 FR 63375 Notice of Document Availability, Draft Conservation Agreement
1998	62 FR 67398 Notice of Comment Extension for Draft Conservation Agreement
1998	63 FR 16218 Notice 1-year Petition Finding, Not Warranted.
1999	64 FR 57533 Notice Candidacy Removal/Rclass, Additional Pops, Individuals, Habitat.
2001	66 FR 47034 Notice of Intent to Prepare a Status Review and Revised 12-month Finding.

e. Federal Status and Petition History of Spotted Frog

On May 1, 1989, the Service received a petition from the Board of Directors of the Utah Nature Study Society requesting the Service add the spotted frog (then referred to as *Rana pretiosa*) to the List of Threatened and Endangered Species and to specifically consider the status of the

Wasatch Front, Utah population. The petitioners stated that “the spotted frog’s present range in the lower 48 states is greatly reduced from its historic range,” and that “the current status [of the species] is greatly reduced from historic times.” The petitioners further indicated that the “scientific importance of the spotted frog is that this species lives in many disjunct populations that reflect Pleistocene populations.” Threats identified by the petitioners included loss of habitat (caused by dam and reservoir construction, alteration of drainage patterns, urban and agricultural use of water, and highway and bridge construction); introductions of exotic species; lack of inventories of native wetland animals; insufficient impact analyses conducted prior to development; and inadequate mitigation activities. In addition, the petitioners alluded that Federal and State laws and regulations do not adequately protect wetlands and riparian areas for the spotted frog.

The Service published a notice of a 90-day finding in the Federal Register (54 FR 42529) on October 17, 1989, concluding there was substantial information that the petitioned action may be warranted. Concurrent with publishing the notice, the Service initiated a status review. The period of the status review was prolonged because, throughout its wide range, there was a lack of quantitative information documenting the spotted frog’s current distribution and status. Genetics research raised further questions regarding the appropriateness of the then-current taxonomic classification of spotted frog populations.

A notice of the 12-month petition finding was published in the Federal Register (58 FR 27260) on May 7, 1993. In the 12-month petition finding, the Service determined that listing the spotted frog as threatened in some portions of its range was warranted but precluded by other higher priority listing actions. The Service found, based on geographic and climatic separation and supported by genetic separation (Green 1991), five Distinct Vertebrate Populations (DPS) of spotted frogs throughout its range--(1) the main population (Alaska, British Columbia, Alberta, Wyoming, Montana, north and central Idaho, eastern Washington, and northeastern Oregon), (2) the Great Basin (southern Idaho and Nevada), (3) West Coast (western Washington, Oregon, Idaho, and Nevada), (4) the Wasatch Front, Utah, and (5) the West Desert, Utah. Separation of the West Desert and Wasatch Front DPSs in Utah is supported by geographic isolation in addition to ecological and demographic distinctiveness (Bos and Sites 2001).

Four of the five DPSs (all but the main population) were found to be warranted but precluded by higher listing priorities; both Utah populations were designated as candidates for listing. In Utah, the Wasatch Front population was assigned a listing priority number of three because the magnitude of the threats were high and imminent, while the West Desert population was assigned a listing priority of nine because of moderate to low threats.

On November 15, 1994, the Service published a Candidate Notice of Review in the Federal Register for the four candidate DPSs (59 FR 58982). The listing priority for the West Desert DPS was increased from nine to six. In the Service’s September 19, 1997, Candidate Notice of Review, the scientific and common name of the Wasatch Front, West Desert, and Great Basin DPSs were changed to *Rana luteiventris* and Columbia spotted frog respectively, based on new genetics information (Green et al. 1997).

On November 28, 1997, the Service announced the availability of a Draft Conservation Agreement for the Wasatch Front and West Desert populations (Utah) of the spotted frog (*Rana luteiventris*) (62 FR 63375). The Service received a request to extend the comment period, and on December 24, 1997, announced that the comment period on the Draft Conservation Agreement had been extended until January 16, 1998 (62 FR 67398). The Service subsequently signed the Conservation Agreement (Agreement) on February 13, 1998, in cooperation with the Utah Division of Wildlife Resources (UDWR), Bureau of Land Management (BLM), Bureau of Reclamation (USBR), Utah Reclamation Mitigation and Conservation Commission (URMCC), Central Utah Water Conservancy District (District), and the Confederated Tribes of the Goshute Federation.

The goal of this interagency Agreement is to ensure the long-term conservation of the spotted frog within its historical range in Utah. The Agreement established a mechanism for the recovery of the spotted frog through interagency cooperation, coordination of conservation efforts, and development of recovery priorities. Due to numerous activities and studies in addition to and pursuant with the Agreement, we determined that the status of the species in Utah had improved and that the spotted frog was no longer warranted listing under the Act on April 2, 1998 (63 FR 16218). With this finding, both DPSs of spotted frog in Utah were removed as candidates for listing on October 25, 1999 (64 FR 57533).

On June 8, 1999, a complaint was filed by the Biodiversity Legal Foundation and Peter Hovingh challenging the not warranted finding as violating the Act and the Administrative Procedure Act. The complaint alleged that the not warranted finding was inconsistent with the 8 years of prior determinations by the Service; that the Wasatch Front population of the spotted frog deserved listing under the Act; that the Wasatch Front population of the spotted frog had declined during the course of the 8-year administrative process; that the Conservation Agreement contained future and voluntary actions that had yet to be implemented and had not proven successful at protecting the Wasatch Front population of the spotted frog; and that all measures identified by the Service as having previously been implemented had either failed, had been rejected by the Service as inadequate, or were adopted to mitigate specific projects that had already destroyed spotted frogs and their wetland and aquatic habitat.

On August 6, 2001, the plaintiffs and the Government reached a settlement regarding this complaint. The settlement stipulated that we remand for reconsideration the 1998 “not warranted” finding and start a new status review and 12-month finding on the Wasatch Front population of the spotted frog to be completed by July 31, 2002. The Service subsequently published a notice of intent to conduct the 12-month finding on September 10, 2001 (66 FR 47034). The settlement also stated that we would not vacate our previous determination in the interim. Candidate status of this species would not be restored unless and until we determine in the revised 12-month finding that the species is warranted for listing, or warranted but precluded from listing by higher priority listing actions.

IV. EVALUATION METHODS

a. Agency Jurisdiction

Management of Wasatch Front spotted frog populations is the responsibility of the UDWR. Authority for management of spotted frog habitat lies with Federal and State land management agencies, and private landowners.

a.i. Federal Jurisdiction

The URMCC and the USBR are the only Federal agencies with jurisdiction over lands currently containing spotted frogs on the Wasatch Front. The URMCC manages lands and spotted frog habitats in the Heber Valley as part of the Provo River Restoration Project (PRRP) and in the Mona Springs Complex in Juab Valley. The USBR oversees spotted frog ponds just below Jordanelle Reservoir, directly upstream of the PRRP. The USFS oversees a portion the spotted frog locations in the of the upper Provo River.

a.ii. State Jurisdiction

The UDWR has management responsibility for spotted frogs on the Wasatch Front. Lands containing spotted frogs that are under State ownership include the Springville Hatchery. The spotted frog is a State-sensitive species managed under an interagency Agreement.

a.iii. Local or Private Jurisdiction

Current and historically occupied spotted frog habitats on the Wasatch Front occur on private lands. Management authority for fish and wildlife, including the spotted frog, remains with the State government.

b. Sources of Information

Information sources used in this review include:

- (1) all comments received by the Service's request for comments (66 FR 47034; September 10, 2001);
- (2) comprehensive review of the published scientific literature;
- (3) unpublished agency reports and literature;
- (4) land management and agency management, planning and decision documents, plans or strategies; and
- (5) personal communications with pertinent academic and professional amphibian and aquatic experts, State and Federal agency wildlife managers, and known groups or individuals with specific relevant knowledge of the status of the spotted frog and its habitat.

(6) land use and growth projection data layers acquired from UDWR (Lee 2000), and evaluated using ArcView GIS software. Information such as urban growth projections were derived from this information at site-specific levels for spotted frog populations.

c. Geographic Organization

Spotted frogs in Utah range variously throughout the eastern and southwestern portions of the Bonneville Basin in Utah, which covers most of the central and western portion of Utah (Perkins and Lentsch 1998). Suitable spotted frog habitat within this range is broken into four natural geographic areas, henceforth referred to as Geographic Management Units (GMU) (Figure 2). These GMUs include the Bear River, Wasatch Front, Sevier River, and West Desert.

For the purposes of this status review, the Wasatch Front and Sevier River GMUs, plus a portion of the West Desert GMU, collectively comprise the Wasatch Front DPS of the spotted frog. The Bear River GMU, which encompasses the far northeastern portion of the Bonneville Basin, is geographically and hydrologically connected to the Wasatch Front GMU. However, surveys have not confirmed the historic or current presence of spotted frogs in the Bear River drainage (U.S. Fish and Wildlife Service 1993, Perkins and Lentsch 1998). In 1997, one individual was reported in an area near Hardware Ranch; however, the identification is was never confirmed and subsequent surveys have not located any spotted frogs in the area. The UDWR continues to manage this GMU as potential habitat and conducts periodic surveys for spotted frogs; however, the Bear River GMU will not be considered further in this status review.

In spring 2002, a new population of spotted frog near the town of Vernon in the Rush Valley was discovered (currently part of the West Desert GMU). The Service, in consultation with the State of Utah, has determined to include this population in the scope of this status review based on geographical and ecological considerations. However, we will continue to evaluate any further information regarding the ecology, population status, and genetic characteristics of this new population.

d. Data Organization

Data from all comments, documents, reports, publications and other information were incorporated into the database. Accuracy and comprehensiveness of the data were ensured by the status review team, local biologists, land managers, and other academic and professional experts. Specific comments were incorporated where applicable. Data by geographic area were reviewed in draft by area biologists, managers, and species experts to assess accuracy and completeness. The status review team worked with local biologists up through final drafts to ensure that information was updated and accurate.

Status and trends of the spotted frog were evaluated using the following parameters-- (1) geographic and distribution information, (2) spotted frog population status, (3) threats to the long-term persistence of the spotted frog and (4) conservation actions that are ongoing or completed that protect the spotted frog. Threats were categorized and evaluated under each of the five listing factors for all populations in the Wasatch Front DPS.

e. Temporal Evaluation Criterion

To reduce subjectivity and ensure a thorough and unbiased evaluation, this review and subsequent findings are based on a specific temporal criterion applied to each of the three GMUs. Data were collected to describe spotted frog status for four points in time--(1) early to mid-1900s as described from available historic species information, (2) 1993 status as described in UDWR survey reports and the 12-month finding produced by the Service, (3) 1998 as described in reports and the 12-month finding produced by the Service, and (4) current status as described from data collected for this status report. Spotted frog status and distribution trends are thus considered across an approximately 100-year time frame, which allows an objective assessment of spotted frog status and future trends.

V. ECOLOGY

a. Species Description

Spotted frogs belong to the anuran family of “true frogs,” Ranidae. Twenty-three species of ranids occur in the United States of which only three are native to Utah; the northern leopard frog (*Rana pipiens*), the relict leopard frog (*Rana onca*; extirpated from Utah), and the spotted frog. The green frog (*Rana clamitans*) and the bull frog (*Rana catesbeiana*) also occur in Utah; however, they were released into these habitats and do not naturally occur west of the Rocky Mountains.

Ranids are typically characterized as slim-waisted, long-legged, smooth-skinned jumpers with webbed hind feet and a pair of dorsolateral folds (glandular folds) that extend from behind the eyes to the lower back. In Utah, adult spotted frogs range from 40 to 100 millimeters (Tanner 1931, UDWR in prep.) and average between 45 and 80 mm (Ross et al. 1993, 1994, UDWR unpubl. data.) in snout vent length. Color and pattern descriptions of individuals from Utah include a brownish-black dorsal coloration with little or no spotting pattern. They differ from spotted frogs in the Pacific Northwest which possess numerous dorsal spots (Nussbaum et al. 1983, Stebbins 1985). Coloration can be quite variable among populations in Utah. Spotted frogs along the Wasatch Front generally possess a salmon color ventrally. West Desert and Sanpete County populations generally exhibit yellow to yellow-orange coloration ventrally. The throat and the ventral region are sometimes mottled. The head has a dark mask with a light stripe on the upper jaw and the eyes are turned slightly upward. Dorsolateral folds are usually present in spotted frogs but may be absent in some individuals. Male frogs have swollen thumbs with darkened bases.

b. Distribution

The overall distribution of the spotted frog is continuous throughout extreme southeastern Alaska, southwestern Yukon, northern British Columbia, and western Alberta; and south through Washington (east of the Cascades), eastern Oregon, Idaho, and western Montana. Its southern extent includes disjunct populations in central and northeastern Nevada, southwestern Idaho, western and north-central Wyoming, and northern Utah (Stebbins 1985; Green et al. 1996, 1997, Tanner 1931, Linsdale 1940, Banta 1965, Turner and Dumas 1972, Hovingh 1993, Ross et al. 1993, 1994). These disjunct populations are highly fragmented, occurring on isolated mountains and in arid-land springs.

Spotted frog populations in Utah represent the southern extent of the species range (Stebbins 1985). Post-glacial climatic shifts allowed spotted frog populations to naturally distribute across drainage areas of the Bonneville Basin of Utah. The Bonneville Basin encompasses the area that was covered by ancient Lake Bonneville and which, today, lies within the Great Basin province. The Great Basin province is distinguished geologically by parallel north-south mountain ranges separated by broad, alluvial desert basins (Christiansen 1951) and valleys. The steep, gravelly slopes of these ranges are prominently marked by benches and other shore features of Lake Bonneville. Springs commonly occur at the base of the mountains (Bick 1966) and in the valley floors. Several aquatic species have maintained an existence as relict populations in these springs, including the spotted frog, least chub, and several species of mollusks.

The West Desert spotted frog population occurs mainly in four large spring complexes. One new population, Vernon, was recently discovered in the eastern-most portion of the West Desert GMU. Populations have been extirpated from the northern portions of the West Desert range.

The Wasatch Front population occurs in isolated springs or riparian wetlands in Juab, Sanpete, Summit, Utah, Tooele, and Wasatch Counties. Columbia spotted frogs have been extirpated from the Salt Lake Valley and tributaries to the Jordan River and Great Salt Lake due to habitat loss from urban development. Currently, there are seven localized populations of spotted frog that comprise the Wasatch Front population or DPS. The largest known concentration is currently in the Heber Valley; the remaining six locations are Jordanelle/Francis, Springville Hatchery, Holladay Springs, Mona Springs Complex/Burraston Ponds, Fairview, and Vernon.

c. Systematics and Taxonomy

Systematic and taxonomic relationships of spotted frogs occurring in Utah to other spotted frog populations have been described in several manners. Two subspecies of *Rana pretiosa* were described originally (Thompson 1913, Wright and Wright 1949). These two subspecies, *R. p. pretiosa* and *R. p. luteiventris*, were described based on pigmentation characteristics of frogs. As additional specimens were examined, variability of characteristics within and between populations was described (Morris and Tanner 1969). Green et al. (1996) examined allozyme

and morphometric variation in *R. pretiosa* and suggested that at least two species were represented, referred to as species A (southwestern Washington and Oregon Cascades) and species B (remainder of range). However, morphometrically the two species were “almost indistinguishable” and the authors could not fully delineate the dividing line between the ranges of species A and species B. Based on biochemical and morphological data, Green et al. (1997) concluded that there were two groups at the species level--Oregon spotted frog (*Rana pretiosa*) and Columbia spotted frog (*Rana luteiventris*). They determined that all spotted frog populations occurring within Utah should be taxonomically described as *Rana luteiventris*. On September 19, 1997, the Service updated the common and scientific names of the Utah populations to the Columbia spotted frog, *Rana luteiventris*.

Further analyses of taxonomic relationships among range-wide spotted frog populations were performed by Bos and Sites (2001). This study revealed four genetically distinct lineages. Two of these lineages are represented in Utah--(1) the Deep Creek lineage (Deep Creek- Ibapah population in the West Desert DPS) and (2) the Bonneville lineage (all other populations in Utah, including the Wasatch Front and the remainder of the West Desert DPSs). The Wasatch Front DPS appears to have originated from the West Desert populations in relatively recent evolutionary time, during the recession of Lake Bonneville (Toline and Seitz 1999, Bos and Sites 2001). Therefore, genetic differences between these populations have not yet been established. However, separation of the West Desert and Wasatch Front DPSs is supported by ecological and demographic distinctiveness due to geographic isolation and habitat differences, including disparate biological, chemical, and thermal characteristics of occupied springs and wetlands (Hovingh 1993, U.S. Fish and Wildlife Service 1993). In addition, due to the dependence of spotted frogs on aquatic habitats and population isolation (Toline and Seitz 1999), there is likely no gene flow existing between the Wasatch Front and West Desert DPSs.

d. Ecology and Life History

Spotted frogs are aquatic specialists and more dependent on permanent aquatic habitats than other ranid species (Perkins and Lentsch 1998, Ammon 2002). The majority of sightings and captures of this species have occurred while the frogs were submersed in water. Range-wide, spotted frogs use a variety of habitat types including cold water ponds, streams, lakes, and springs adjacent to mixed coniferous and subalpine forest, grassland, and brush land (Morris and Tanner 1969, Stebbins 1985). On the Wasatch Front, they are usually found in emergent wetlands associated with riparian or isolated spring-fed habitat with cool and organic substrates (Dumas 1966, Morris and Tanner 1969, Cuellar 1994). Habitat usually consists of a small spring, pond, or slough with a variety of herbaceous emergent, floating, and submergent vegetation. Spring vegetation most commonly associated with the spotted frog on the Wasatch Front includes: bullrush (*Scirpus sp.*), sedges (*Carex spp*), cattails (*Typha sp.*), duckweed (lemnaceae), rushes (*Juncus spp.*), watercress (*Nasturtium officinale*), grasses (*Graminae*), and algae (Ross et al. 1994). Morris and Tanner (1969) suggest that deep silt or muck bottoms are required for hibernation and torpor.

Spotted frogs emerge from hibernation in the spring and tend to use different habitats depending on their needs. For example, in Yellowstone National Park sexually immature individuals tended to inhabit aquatic habitats away from breeding adults (Turner 1958). Breeding adults may use areas in the absence of other age-classes, and move to sites near younger frogs as the water begins receding from the breeding area (Turner 1958). Turner (1960) suggested that spotted frogs have small home ranges. In Yellowstone National Park frogs were recaptured at or near the same location used for breeding. This hypothesis is supported by studies of spotted frogs in the Heber Valley where most individuals were recaptured in the site of their initial capture (Ammon and Wilson 2001).

Recent studies have evaluated spotted frog locations and movements outside of the breeding season. Ongoing research in the Heber Valley of Utah indicates that spotted frogs travel short distances between breeding and post-breeding habitats, and many breeding sites serve as year-round habitat (Ammon and Wilson 2001). Bull and Hayes (2001) noted post-breeding dispersal distances of 15 to 560 m in spotted frogs in northeastern Oregon. Dispersal patterns were related to pond size, water temperatures, and proximity to other sources of permanent water. Dispersal corridors are typically limited to aquatic or semi-aquatic habitats such as streams, intermittent drainages, and seeps (Ross and Peterson 1998). Intensive mark-recapture and radiotelemetry studies are needed to determine actual movement distances and patterns in this and other Utah populations.

Breeding occurs early with the spring thaw. Spotted frogs are known to use temporary bodies of water for breeding in more mesic parts of their range (Turner 1960, Licht 1971), but in Utah breeding sites are predominantly associated with a spring or some other permanent water source (Morris and Tanner 1969, Hovingh 1993, Ross et al. 1993, Ross et al. 1994).

Wasatch Front spotted frog populations begin breeding in early-March; populations at higher elevations delay breeding until mid-March, and continue through late-April (UDWR data on file). Elevation differences in spotted frog breeding seasons have been reported in British Columbia (Licht 1975) and Yellowstone National Park (Turner 1958), and are attributed to temperature differences.

Breeding usually begins with a male vocalizing, stimulating the other males to call simultaneously. The vocalization is described as a “clicking” noise (Morris and Tanner 1969), but also may be described as a soft “bubbling” sound. Calls consist of 4-50 clicks per call and last about 1-10 seconds (Stebbins 1985).

Egg deposition is stimulated by a single pair of frogs followed by other spotted frogs depositing eggs in the same area. It has been reported that they will deposit eggs in the same area annually (Morris and Tanner 1969, Nussbaum et al. 1983). Individual females may oviposit more than one clutch of eggs annually (Morris and Tanner 1969); however, this has not been confirmed in Utah populations. Sex ratios have not been quantified in Utah. For estimates of effective population size (N_e), UDWR used estimates of 1:1 sex ratios as derived from egg mass monitoring information during 1991-1993 surveys (Ross et al. 1993, 1994).

Egg masses tend to be deposited in open, shallow (<20 cm) areas within 2 m of the shoreline with water temperatures ranging between 11°C and 20°C (Ross et al. 1993, 1994). Egg masses are weakly adhesive and form an irregular mass or globular cluster approximately 7.5 to 20 cm in diameter. They may become weakly attached to vegetation (*Chara* spp.) for a short period of time. Eventually the mass floats to the surface, exposing the top layer of eggs. Wind and water currents often move masses around and they may begin to break up. Eventually the egg masses may become separated and covered with debris. Number of eggs per egg mass are quite variable, ranging from 147 to 1,160 eggs (Toone 1991). Individual eggs are typically larger than those of other ranids. Hatching rates vary directly with water temperature (Toone 1991).

Studies in Montana, Oregon, and British Columbia have documented that insects are the primary prey for the spotted frog (Miller 1978, Whitaker et al. 1982, Licht 1986). These studies were performed in portions of the species range outside of Utah where spotted frogs inhabit different habitat types and may exhibit different life history characteristics. However, absent site-specific information, we can assume that the feeding habits of spotted frogs in Utah are similar to those documented in other areas.

e. Criteria for Defining Spotted Frog Populations

Populations of spotted frogs on the Wasatch Front are geographically isolated from each other due to natural geographic separation and human-caused habitat fragmentation. Spotted frog “populations” have been identified on the Wasatch Front to help prioritize current management strategies.

Populations were identified, in part, based on the current isolation of populations, which can be a concern for the long-term viability of the species. Nonetheless, this status review will discuss the threats and conservation actions for each individual population, keeping in mind that the current isolation of some populations is largely an artifact of historic and ongoing land-use practices. Individual collections or occurrences were collectively determined to be a single population or separate based on the following criteria derived from known spotted frog biology (e.g., dispersal distances (UDWR 2002b)):

- The presence of a major barrier to dispersal, such as a busy interstate highway, highway with impassable obstructions, major river (greater than 50 m wide at low flow), or other untraversable conditions, or habitat in which site-specific data indicate the frogs virtually never occur (e.g., some semiarid shrubland habitats);
- Separation of at least 1 km (0.6 mi) of marginal but occasionally traversable habitat. Marginal habitat can be comprised of habitat (e.g., wet meadows) that is sometimes traversable by spotted frogs; however, the distance of 1 km (0.6 mi) makes movement between populations unlikely*;
- Separation of at least 5 km (3 mi) of suitable habitat between occurrences in different drainages in montane habitat will make movement between populations unlikely*;

- Separation of at least 10 km (6 mi) of suitable habitat for occurrences within a drainage in montane habitat will make movement between populations unlikely*.

* A shorter distance can be used if site-specific data indicate that individuals in adjacent populations are not likely to come into contact with each other.

Engle and Munger (2000) studied spotted frog movements in the Owyhee Mountains in Idaho and reported that while five adults moved distances greater than 1,000 m, most movements were under 500 m. In a study of spotted frogs in the Heber Valley of Utah, Ammon and Wilson (2002) reported most frogs moved distances less than 100 m but one individual moved 548 m. Bull and Hayes (2001) noted post-breeding dispersal distances of 15 to 560 m in spotted frogs in northeastern Oregon. The current spotted frog populations on the Wasatch Front likely do not exchange individuals or gene flow.

VI. STATUS SUMMARY

a. Historic Status of Spotted Frogs on the Wasatch Front (Early 1990s to 1980s)

Comprehensive information on the historic status and distribution of the spotted frog on the Wasatch Front is limited. Pre-1990 quantitative information is confined to scant museum collection records and surveys conducted in the early to mid-1900s (Van Denburgh and Slevin 1915, Tanner 1931, Tanner 1940, Turner 1960, Morris and Tanner 1969). This information documents 13 historic populations in the San Pitch River, Spanish Fork River, Utah Lake, Provo River, Jordan River, and Upper Weber River drainages (Table 1). However, anecdotal information from landowners and other local individuals (K. Wilson, UDWR, pers. comm.; Paula Trater, private individual, pers. comm.) and observations made by early researchers regarding the status of specific populations (Tanner 1931, Tanner 1940, Turner 1960) indicates that the spotted frog was probably the most historically abundant frog around the Wasatch Front.

Table 1. Historic Records of Spotted Frogs on the Wasatch Front.

GMU	Subunit	County	Population	Date
Wasatch Front	Upper Weber River	Summit	Hoytsville	1957 ^{b,f}
Wasatch Front	Upper Weber River	Summit	Park City	1931 ^a
Wasatch Front	Upper Weber River	Summit	Beaver Creek/Kamas	1931 ^{b,c,f}
Wasatch Front	Provo River	Summit/Wasatch	Jordanelle/Francis	1931 ^{b,c,f}
Wasatch Front	Provo River	Wasatch	Heber Valley	1931 ^{a,b,c,f}
Wasatch Front	Provo River	Utah	Provo	1931 ^{a,b,d,f}
Wasatch Front	Provo River	Utah	Springdell	1926 ^{a,b,f}

Wasatch Front	Provo River	Utah	Vivian Park	1931 ^{a,b,d,f}
Wasatch Front	Utah Lake	Juab	Burraston Ponds/ Mona Springs Complex	1960 ^{b,c,d,f}
Wasatch Front	Jordan River	Salt Lake	Murray	1930 ^b
Wasatch Front	Jordan River	Salt Lake	Fort Douglas	1931 ^a
Wasatch Front	Jordan River	Salt Lake	Bluffdale	1968 ^c
Sevier River	San Pitch River	San Pete	Fairview	1939 ^{b,c,d,e,f}

^a Tanner 1931.

^b Toone 1991.

^c Ross et al. 1993.

^d Morris and Tanner 1969.

^e Tanner 1940.

^f Museum record.

b. 1993 Status of Spotted Frogs on the Wasatch Front

On May 17, 1993, the Service found that the spotted frog was warranted for listing under the Act, but precluded by higher listing priorities throughout portions of its range, including Utah (58 FR 27260). Despite the lack of survey and abundance data to indicate the exact status and trends of the species, it was clear by the early 1990s that spotted frogs on the Wasatch Front had significantly declined (Ross et al. 1993). In fact, by the late 1980s the spotted frog was speculated to be extirpated from the Wasatch Front (Hovingh 1987, UDWR 1991).

Historical declines in spotted frog numbers, population extirpations, and reduction in range were attributed to habitat loss and degradation (Hovingh 1993, Ross et al. 1993, Perkins and Lentsch 1998) from a range of activities (Table 2) that resulted in large-scale wetland losses (Dahl 1990). Threats arising from urban population growth (e.g., urbanization, water development) were implicated in the extirpation of 7 of 12 documented spotted frog populations, including all populations that were historically documented in the Salt Lake Valley.

Planned Federal water projects and the 1989 petition to list the spotted frog under the Act prompted increased efforts to acquire more information on the status of the species. During 1991 and 1992, all historically known locations, in addition to some potential habitats within historic range along the Wasatch Front, were surveyed for the occurrence of spotted frogs (Ross et al. 1993). These surveys, while cursory, represented the first survey effort specifically targeted at spotted frogs.

Table 2. Suspected Reasons for Extirpation of Historic Spotted Frog Populations, Wasatch Front, Utah.

GMU	Subunit	County	Population	Suspected Cause of Extirpation
Wasatch Front	Upper Weber River	Summit	Hoytsville	Water diversion, grazing
Wasatch Front	Upper Weber River	Summit	Park City	Urban development
Wasatch Front	Upper Weber River	Summit	Beaver Creek/ Kamas	Unknown, grazing
Wasatch Front	Provo River	Summit/Wasatch	Jordanelle Reservoir	Reservoir development
Wasatch Front	Provo River	Wasatch	Wallsburg	Water diversion, grazing
Wasatch Front	Provo River	Utah	Provo	Urban development
Wasatch Front	Provo River	Utah	Spingdell	Urban development, water diversion
Wasatch Front	Provo River	Utah	Vivan Park	Urban development, water diversion
Wasatch Front	Provo River	Utah	Salamander Lake	Unknown
Wasatch Front	Jordan River	Salt Lake	Murray	Urban development
Wasatch Front	Jordan River	Salt Lake	Fort Douglas	Urban development
Wasatch Front	Jordan River	Salt Lake	Bluffdale	Urban development

Survey results indicated that the distribution and abundance of spotted frogs along the Wasatch Front had been significantly reduced (Ross et al 1993). Nine populations of spotted frogs, comprising 56 separate locations, were found in Juab, Sanpete, Utah, and Wasatch Counties (Table 3). The presence of spotted frogs was confirmed at 5 of the 13 historically known locations. Most populations within the highly urbanized areas including the Salt Lake and Utah Valleys and Park City had been extirpated. In the Provo River drainage, spotted frogs were

confirmed in the main stem corridor, but not in side canyons in which they had historically occurred. However, surveys also identified five previously unknown populations in the Spanish Fork River, Utah Lake, and Provo River subunits. These “new” populations most likely existed historically, but were identified only recently due to the increased survey efforts.

Surveys indicated that, based on low numbers of egg masses and juvenile and adult frogs, most populations of spotted frogs on the Wasatch Front consisted of relatively few individuals (Ross et al. 1993). These populations were suspected to be below long-term sustainable population levels based on estimated population numbers required to maintain long-term genetic viability (Begone et al. 1990). Due to habitat loss, spotted frog populations had become isolated from each other. The distribution and location of known populations and potential habitats reduced the potential for natural dispersal of individuals and exchange of genetic material. Populations were thus more vulnerable to localized extirpations (Ross et al. 1993).

Table 3. Known Spotted Frog Populations on the Wasatch Front in 1993.

GMU	Subunit	County	Occurrence
Wasatch Front	Provo River	Summit/Wasatch	Jordanelle/Francis
Wasatch Front	Provo River	Summit/Wasatch	Jordanelle Reservoir ¹
Wasatch Front	Provo River	Wasatch	Heber Valley
Wasatch Front	Provo River	Wasatch	Wallsburg ¹
Wasatch Front	Provo River	Utah	Springville Hatchery/T-Bone Bottom ¹
Wasatch Front	Provo River	Utah	Salamander Lake ¹
Wasatch Front	Utah Lake	Juab	Burraston Ponds/ Mona Springs Complex
Wasatch Front	Spanish Fork River	Utah	Holladay Springs ¹
Sevier River	San Pitch River	San Pete	Fairview

¹ Previously unknown population.

c. 1998 Status of Spotted Frogs on the Wasatch Front

By 1998, there were six known spotted frog populations on the Wasatch Front (Table 4). Three populations (Jordanelle Reservoir, Wallsburg, Salamander Lake) that were observed in the 1991-1992 surveys were considered extirpated. After salvage and translocation efforts, the Jordanelle Reservoir population was extirpated by 1993, after the construction and filling of Jordanelle Reservoir; spotted frogs had not been observed at the Wallsburg and Salamander Lake locations since 1991.

Beginning in 1996-1997, conservation and protection efforts for the spotted frog escalated. Monitoring of egg mass numbers indicated stable trends in the six extant populations. Land and water acquisitions in some populations (i.e., Heber Valley, Mona Springs Complex); and acquisitions of other potential spotted frog habitats on the Wasatch Front were underway. Although some of these actions were achieved as the result of mitigation for water development projects, and the water development projects themselves caused impacts to the spotted frog, the end result was that some extant spotted frog populations (i.e., Heber Valley, part of the Mona Springs Complex) and potential habitats (e.g., Utah Lake Wetland Preserve) were protected in perpetuity. Furthermore, development of the Agreement in 1997-1998 significantly increased active management and awareness for the spotted frog and provided a partnership and process for more effectively addressing threats, managing, and protecting populations.

On April 2, 1998, the Service found that the two spotted frog DPSs in Utah (Wasatch Front and West Desert) were not warranted for listing under the Act (63 FR 16218).

Table 4. Known Spotted Frog Populations on the Wasatch Front in Early 1998.

GMU	Subunit	County	Occurrence
Wasatch Front	Provo River	Summit/Wasatch	Jordanelle/Francis
Wasatch Front	Provo River	Wasatch	Heber Valley
Wasatch Front	Provo River	Utah	Springville Hatchery/T-Bone Bottom ¹
Wasatch Front	Utah Lake	Juab	Burraston Ponds/ Mona Springs Complex
Wasatch Front	Spanish Fork River	Utah	Holladay Springs ¹
Sevier River	San Pitch River	San Pete	Fairview

¹ Previously unknown population.

d. Current Status of Spotted Frogs on the Wasatch Front

There are seven extant spotted frog populations (Figure 3, Table 5) on the Wasatch Front. No spotted frog populations are known to have been lost on the Wasatch Front since 1993.

Table 5. Current Spotted Frog Populations on the Wasatch Front.

GMU	Subunit	County	Occurrence
Wasatch Front	Provo River	Summit/Wasatch	Jordanelle/Francis
Wasatch Front	Provo River	Wasatch	Heber Valley
Wasatch Front	Provo River	Utah	Springville Hatchery/T-Bone Bottom
Wasatch Front	Utah Lake	Juab	Burraston Ponds/ Mona Springs Complex
Wasatch Front	Spanish Fork River	Utah	Holladay Springs
Sevier River	San Pitch River	San Pete	Fairview
West Desert	Tooele Valley	Tooele	Vernon ¹

¹ Discovered spring of 2002.

In spring 2002, survey efforts discovered a new spotted frog population in the Rush Valley near the town of Vernon, Tooele County, Utah. On April 29, four spotted frog egg masses were observed in one breeding site; spotted frog tadpoles were found during follow-up surveys on May 22 (UDWR 2002c). Species identification was confirmed by a tadpole that metamorphosed in UDWR facilities and was positively identified as a spotted frog (K. Wilson, UDWR, pers. comm.).

Habitat for the Vernon population of spotted frogs consists of a complex of spring-fed wetlands on privately-owned lands. The known distribution of this population may expand as surveys continue in nearby suitable habitats (UDWR 2002c). This population represents the first record of spotted frogs in the Rush Valley. Furthermore, it is the first documentation of a new spotted frog population since the early 1990s.

When the Service designated two spotted frog DPSs, the Wasatch Front and West Desert in 1993, the Vernon population was not known to exist. Under the Agreement, the region where this population was discovered is in the West Desert GMU. However, DPS and GMU definitions were based on different criteria; location of a population in the West Desert GMU that do not necessarily place it in the West Desert DPS. Designation of the two DPSs, and

placement of specific populations in each, were based primarily on geographic separation, ecological and climatic differences, apparent morphological differences, and presumed genetic distinctions (USFWS 1993). Based on current knowledge, these criteria apply to the Vernon population as follows:

- Geographic Separation--Based on linear distance, the Vernon population is geographically closer to the Wasatch Front DPS (53 km from the nearest Wasatch Front population and 114 km from the nearest West Desert population).
- Ecological and Climatic Differences--Spotted frog habitat in the Vernon population appears similar to the spotted frog habitats found in the Wasatch Front DPS (i.e., Fairview, Mona/Burraston).
- Morphology--There are no data on the morphology of the Vernon spotted frogs.
- Genetic Distinction--There are no genetic data available for the Vernon spotted frogs; however, previous genetic studies of Utah spotted frogs (i.e., Green et al 1996, Toline and Seitz 1999, Bos and Sites 2001) indicate that there are no genetic differences between the Wasatch Front and West Desert DPSs.

Given that the DPS designation was based primarily on geographic separation and ecological and climatic differences, the Service is considering the Vernon population part of the Wasatch Front DPS for the purposes of this status review. However, we will continue to evaluate any further information regarding the ecology, population status, and genetic characteristics of this new population.

All Wasatch Front spotted frog populations (except the Vernon population) have been monitored annually since 1994 (plus initial 1991-1992 survey data). Monitoring consists of using egg mass counts as an estimate for the number of breeding adults in the population, or effective population size. Although the mating system of spotted frogs is not completely understood, the assumption has been made that every egg mass is the product of a single male and a single female (Perkins and Lentsch 1998). Under this assumption, the egg masses represent one-half the number of breeding adults. Further investigation is required to better understand the relationship of egg mass numbers to the number of breeding adults to obtain accurate estimates of effective population sizes; however, relative population trends can safely be inferred from current knowledge of the applicability of egg mass numbers to spotted frog populations.

Most of the extant spotted frog populations, with the exception of the Heber Valley, are not currently meeting effective population goals specified in the Conservation Agreement (Perkins and Lentsch 1998). However, these goals as set in 1998 were based on analysis of the available literature (Begone et al. 1990) which was not necessarily the most appropriate for spotted frogs or ranid species in general. It is likely that the size of any given population will be highly dependant on factors such as the size and quality of the habitat and interactions with other species (competition/predation). Therefore, one specific numerical goal is not likely to be

appropriate for all spotted frog populations. Taking these factors into consideration, the population goals set in 1998 are currently being revisited to determine if they are appropriate for the Wasatch Front spotted frog. Furthermore, future research will be directed at answering the questions previously discussed regarding the measurement of effective population size for the spotted frog. Additional goals that address threats, habitat quality, and population function (e.g., successful recruitment and reproduction) are also being developed; these goals will provide help more appropriate measures of success and guidance for spotted frog management.

Spotted frog monitoring occurs at all known breeding sites within each population. A breeding site is defined as a discrete habitat unit (e.g., pond, spring complex, group of beaver ponds) where spotted frog egg masses are deposited (K. Wilson, UDWR. pers. comm.). Individual breeding sites within a population are typically separated by a distance of at least 30 m (98.4 ft) and have a limited hydrologic connection during the breeding season. This definition, as applied to the extant spotted frog populations, was designed to take a conservative approach in estimating the number of breeding sites.

The number of documented breeding sites and known size of most populations have increased since 1999 (see Table 12 and Table 13), and have been considerable for three populations (Fairview, Jordanelle/Francis, Heber Valley). The increase in the number of breeding sites in the Heber Valley is largely attributed to dispersal of spotted frogs into newly created and recently unoccupied areas. Increases in other populations may represent range expansions or simply be a result of increased survey efforts. Regardless, the population levels and distribution of the extant populations are substantially larger than previously thought.

The seven extant spotted frog populations on the Wasatch Front exist in isolated reaches of habitat without inter-connectivity. Population isolation has likely resulted historically from both natural and human-caused factors. The period of greatest connectivity among spotted frogs throughout their range in Utah probably occurred during the time of Lake Bonneville. It is hypothesized that migratory pathways of habitat along the lake margin created connections and allowed for movement among different spotted frog localities (see Hovingh 1993). With the recession of Lake Bonneville, significant isolation of some populations (e.g., Vernon, Fairview) would have occurred naturally with the loss of these migratory pathways. However, historical habitat loss and alteration has resulted in increased isolation of remaining spotted frog populations and habitats (e.g., Jordanelle Reservoir severed the connectivity between the Jordanelle/Francis and Heber Valley populations).

In the following sections, the status of the current Wasatch Front spotted frog populations is discussed by GMU. For each population, the habitat type and condition, land ownership, number of breeding sites, and long-term egg mass numbers are outlined. The threats and conservation actions for each population also are evaluated.

WASATCH FRONT GEOGRAPHIC MANAGEMENT UNIT

Description

The Wasatch Front GMU encompasses the eastern portion of the Bonneville Basin draining the west slope of the Wasatch Mountains. Elevation ranges from approximately 1,520 to 3,050 m (5,000 to 10,000 ft). The natural vegetation community is characterized by sagebrush and grasslands at lower elevations, and aspen and subalpine fir/spruce communities at higher elevations. This area includes all drainages of the Great Salt Lake and comprises five major river basins--the Weber and Ogden drainages which drain the northern Wasatch mountains westward into the Great Salt Lake; the Provo and Spanish Fork Rivers which drain the southern Wasatch Mountains westward into Utah Lake; and the Jordan River which flows from Utah Lake northward to the Great Salt Lake and collects a number of smaller river systems (City Creek, Red Butte, Emigration, Parleys, Big and Little Cottonwood Creeks) from the central Wasatch Mountain through the Salt Lake Valley. Within these drainages, spotted frogs occupy a variety of aquatic habitats from lowland valley spring complexes to high elevation riparian wetlands.

Characterized by urban development and agricultural lands, this GMU includes the most densely populated region of Utah and the large cities of Ogden, Provo, and Salt Lake City. Spotted frogs were historically extirpated from the majority of these urban areas. While the more inaccessible higher elevation habitats have remained relatively pristine, development pressure is advancing into these areas. Population growth rates for the Wasatch Front counties average 3.8 percent and urban areas are expected to further expand (Lee 2001). Despite high levels of existing and projected urbanization, numerous conservation actions have protected large portions of remaining occupied habitats, and some suitable, unoccupied habitats have been acquired on the Wasatch Front.

The Wasatch Front GMU is divided into six subunits for spotted frog management (Perkins and Lentsch 1998)--Utah Lake, Provo River, Spanish Fork River, Jordan River, Upper Weber River, and Lower Weber River. Records indicate that spotted frogs have been found in all subunits except the Middle and Lower Weber River.

UTAH LAKE SUBUNIT

The Utah Lake subunit includes the area that drains from the south into Utah Lake. This subunit has an extensive history of agricultural use, livestock grazing, and urbanization. The only historic record of spotted frogs is the extant Mona/Burraston population.

Mona/Burraston Population

The Mona/Burraston population of spotted frogs comprises two sub-populations--Mona Springs Complex and Burraston Ponds. Located near the town of Mona in Juab County, the two locations are separated by approximately 3.2 km (2 mi), connected by Currant Creek, a small tributary to Mona Reservoir. Part of the Mona spotted frog site is federally owned while the

spotted frogs at Burraston are located on private land adjacent to a State Wildlife Area.

- Burraston Ponds

The Burraston Ponds spotted frog site is a large spring complex. Museum records indicate that spotted frogs were documented at this site as early as 1960. Unoccupied, but suitable spotted frog habitat at the site is largely owned by the UDWR and managed as the Burraston Ponds Wildlife Management Area (WMA). The Burraston Ponds WMA is managed to provide for public recreational and educational opportunities while maintaining and enhancing fish and wildlife values (UDWR 1995). Occupied spotted frog habitat at this site is located on privately-owned lands adjacent to, but not part of, the Burraston Ponds WMA.

- Mona Springs Complex

Morris and Tanner (1969) indicated the historic presence of spotted frogs in areas near Mona Reservoir. The Mona Springs Complex consists of a series of finger-like artesian springs that flow into several large ponds. Of the approximately 42.5-ha (105-ac) site, 34.5 ha (85.5 ac) is owned by the URMCC and managed by the UDWR as part of the Burraston Ponds WMA (Hogrefe 2000, UDWR 2001). The remaining land is privately owned. Mona Springs is comprised of one breeding site (UDWR 2002c).

Threats

Potential threats to the Mona/Burraston spotted frog population include:

- livestock grazing
- urbanization
- water development
- nonnative predators

Historical long-term intense grazing severely impacted portions of the Mona Springs Complex. Overgrazing degraded spotted frog habitat as evidenced by trampled banks, decreased riparian vegetation, increased sedimentation in the spring heads, and poor water quality (Hogrefe 2000). Although grazing remains in some portions of this population, livestock has been removed from the most degraded areas and habitat has significantly improved.

Urban growth is not projected to substantially increase in the Juab Valley, proximal to the Mona/Burraston population until at least 2050 (Table 6). Development is not currently a prevalent land use and is not progressing rapidly in this area. In fact, urban development does not currently exist within one mile of Mona/Burraston, and only 62 acres are projected to be developed by 2020. The nearest area projected for development by 2050 occurs approximately 0.7 miles from the Mona/Burraston spotted frog population. A distance of one mile from development is an appropriate analysis distance for impacts to the extant populations because spotted frogs are highly aquatic in nature and are typically found to move less than 500 m (0.3

mi) away from aquatic habitats (see previous discussion under “Criteria for Defining Spotted Frog Populations”). We don't expect that activities beyond the one mile radius will negatively impact the extant spotted frog populations; analyses provided for the 5 and 10 mile radii provide comparison information and a perspective for the location of future development scenarios relative to occupied spotted frog habitats.

Table 6. Urban growth projections (acres developed) proximal to (1.0 mile, 5.0 mile, 10.0 mile radii) the Mona/Burraston spotted frog population, 2020 and 2050		
Mile(s) radius	Year 2020 Developed (% total area)	Year 2050 Developed (% total area)
1.0 mile	62 (0.3%)	1726 (8.6%)
5.0 mile	316 (0.3%)	12,975 (12.9%)
10.0 mile	2,145 (1.06%)	27,378 (13.6%)

A potential threat to the Mona/Burraston population of spotted frogs is groundwater withdrawals in the Juab Valley. Thiros (1999) estimated, using estimated 1992 water withdrawal rates, and assuming no additional water contributions to the system, the water table could be lowered by 1.5 m (5 ft) and groundwater discharge rates reduced by 38 percent by 2022; however, model predictions indicate that the available groundwater levels to support wetland vegetation is not predicted to significantly decrease in the Mona/Burraston area (Thiros 1999) and habitat for this population of spotted frogs is not likely to be affected. Groundwater levels are currently sufficient to sustain the Mona/Burraston spotted frog population. Early identification and understanding of this potential problem provides adequate time for resource agencies to identify and implement mechanisms to address the issue before it becomes a threat to this population.

The presence of predatory nonnative fishes, primarily mosquitofish, is a potential threat in the Mona/Burraston population (Hogrefe 2000). The large population of mosquitofish at Mona Springs suggests that predation of spotted frog tadpoles could limit recruitment to adult life stages. Raccoons also are present in the Mona Springs and Burraston Ponds area. Spotted frogs have persisted long-term at this site in the presence of nonnative predators suggesting that this does not currently present an imminent threat to this population.

Conservation Actions

- In 1998, the URMCC initiated the acquisition of portions of the Mona Springs Complex to benefit spotted frogs and other sensitive species (UDWR 2001). Of the approximately 42.5-ha (105-ac) site, 81 percent (34.5 ha (85.5 ac)) is owned by the URMCC and managed by the UDWR as part of the Burraston Ponds WMA. This area of the Mona Springs Complex was prioritized for purchase due to severe habitat degradation resulting from overgrazing by livestock (as previously discussed) that required immediate attention to remove threats to this extant spotted frog population. Upland habitats purchased along with the springs also provide a buffer from potential future off-site direct or indirect impacts.

Threat(s) addressed--livestock grazing, urbanization

- In 2000, the UDWR implemented habitat enhancement actions to improve riparian conditions, slow spring succession, and improve water quality (Hogrefe 2000) on the federally-owned portions of the Mona Springs Complex. Direct livestock impacts to spotted frog habitat were addressed by excluding access to these areas with fencing. In addition, cow carcasses and manure also were removed from the area to improve water quality. Livestock are still allowed on the upland areas of the purchased property between May and November through 2004, but only in low densities. Bank stability, riparian vegetation, and water quality have significantly improved in the protected areas (Hogrefe 2000, K. Wilson, UDWR, pers. comm.).

Threat(s) addressed--livestock grazing.

- An Operating Agreement between the URMCC and UDWR protects the federally-owned portion of the Mona Springs Complex as part of the Burraston Ponds WMA and identifies management objectives for the protection and enhancement of this habitat for spotted frogs and other sensitive species (UDWR 2001). Actions include--habitat improvements, spring fencing, spotted frog monitoring, and development of a Habitat Management Plan (HMP) (currently in draft form, under review).

Threat(s) addressed--all.

- The remaining portion of the Mona Springs Complex is under private ownership; UDWR and URMCC are currently negotiating acquisition or purchase of conservation easements on these parcels to protect all springs and other potential spotted frog habitat on the site (Weland 2001).

Threat(s) to be addressed--all.

- The Burraston Ponds WMA, owned and managed by the UDWR, provides currently unoccupied but suitable habitat for spotted frogs at this site. While this property was not specifically purchased for spotted frogs, it provides protection for these wetlands from urban development, livestock grazing, and other negative impacts in perpetuity.

Threat(s) addressed--livestock grazing, urbanization.

- Although not currently identified as a significant threat, research focused on control or removal of nonnatives is being conducted. In 1999, a mechanical removal effort to determine the feasibility of reducing the numbers of nonnative fishes, particularly mosquitofish, was initiated at the Mona Springs Complex. This effort was continued and expanded in 2000 and 2001. Although removal efforts resulted in an initial 90 percent reduction of the total mosquitofish population (UDWR, unpubl. data), mosquitofish populations apparently rebounded to pre-removal numbers within 1 year. However,

mosquitofish numbers were likely reduced during the spring, when spotted frog eggs and tadpoles are most susceptible to predation (UDWR, unpubl. data). Research efforts and analysis are scheduled to continue in the fall of 2002 to determine the most effective means of predator control.

Threat(s) addressed--nonnative predation.

Current and Foreseeable Status

Egg mass counts at the long-term monitoring sites have consistently fluctuated around an annual average of 85 egg masses (low of 61 and a high of 148) since 1995 (see Table 13; Wilson and Olsen 2001). The most recent decrease in egg mass numbers reported for 2002 is likely part of natural, cyclic population fluctuations, related to drought conditions (K. Wilson, UDWR, pers. comm., see Semlitsch 2002), and not predictive of long-term or future population trends. Known breeding sites have increased from four (1994-1998) to seven (1999-2002) (see Table 12). Egg masses found at the new sites increased the total number of egg masses in all years, except 2002. These data indicate that the Mona/Burraston spotted frog population numbers are at a minimum, stable, over the long-term.

Current threats (i.e., grazing) and future potential threats (i.e., long-range development pressure), have been alleviated due to the completed habitat acquisitions. Further conservation actions, including acquisitions, would certainly provide beneficial habitat protection and improvements for the spotted frog, but are not essential to maintaining the long-term viability of this population. Measures to remove and minimize the most imminent potential threats (i.e., grazing, nonnative predators) to the Mona/Burraston spotted frog population have been implemented and are ongoing. Initial efforts focused at acquiring land; managing livestock grazing; and implementing research methods to control nonnative predators. Completed Federal and State land acquisitions and management of occupied and potential spotted frog habitats have reduced the potential for habitat and population loss. Despite the presence of nonnative predators, the Mona/Burraston population appears to be stable, suggesting that this does not currently present an imminent threat to this population. Due to recent conservation and management actions, the immediacy of these and other potential threats has been substantially reduced.

There are remaining private lands in the Mona/Burraston population that can still be improved. Livestock grazing still occurs on the remaining privately-owned portion of Mona Springs. However, habitat degradation from grazing is much less severe in nature than impacts previously observed in the now federally-owned portions, and is not to be a significant impact to this population (K. Wilson, UDWR, pers. comm.). Some grazing impacts (i.e., trampled vegetation) are evident in some occupied spotted frog habitats in the Burraston Ponds site. However, much of the wetland habitat at this site is less accessible to grazers because of the deep spring heads and large areas of open water (K. Wilson, UDWR, pers. comm.). Grazing at this site is dispersed over large pasture areas; however, impacts may increase during dry years if water sources in pasture areas become more concentrated. Impacts to wetland habitats from grazing at Burraston Ponds are further minimized by the use of off-site livestock watering sources which are more

preferred by livestock when available. Given these conditions, grazing is no longer an imminent threat to spotted frogs at the Burraston Ponds site.

SPANISH FORK RIVER SUBUNIT

The Spanish Fork River subunit includes the Spanish Fork River drainage and adjacent areas in the town of Springville that eventually drain into Utah Lake. Extensive urban development, agriculture, and livestock grazing have historically dominated this subunit within incorporated boundaries. There are two known populations in this subunit--Springville Hatchery/T-Bone Bottom and Holladay Springs. T-Bone Bottom is located only a few miles from Springville Hatchery and is considered part of the Springville Hatchery population (Springville Hatchery/T-Bone Bottom). However, these locations are now surrounded entirely by urban development and are completely isolated from each other. Spotted frog egg masses, tadpoles, or adults have not been observed at the T-Bone Bottom location since 1996, and are currently suspected to be extirpated from this site.

Springville Hatchery/T-Bone Bottom Population

- Springville Hatchery

Discovered in 1991 (Ross et al. 1993), the Springville Hatchery site is an isolated spring complex located within the town of Springville. This site is the primary source of water for the Springville Hatchery and the land and water rights are owned by the UDWR.

- T-Bone Bottom

Discovered in 1992 (Ross et al. 1993), the T-Bone Bottom site is isolated within the town of Springville on private land. Habitat at this site consists of a spring complex with adjacent fens.

Threats

Potential threats to the Springville Hatchery/T-bone Bottom spotted frog population include:

- urbanization
- hatchery operations
- nonnative predation
- drought

Effects of past and existing urban development potentially threaten the Springville Hatchery/T-Bone Bottom spotted frog population. Urban development historically caused the loss of habitat and subsequent restriction of this population to the two remaining sites, and development remains immediately adjacent to the Springville Hatchery/T-Bone population. Development is not expected to further increase proximal (within 1.0 mile) to the population, based on 2020 and

2050 growth projections (Table 7). Related impacts include poor water quality and increased sedimentation due to urban runoff into the wetland (K. Wilson, UDWR, pers. comm.). A distance of one mile from development is an appropriate analysis distance for impacts to the extant populations because spotted frogs are highly aquatic in nature and are typically found to move less than 500 m (0.3 mi) away from aquatic habitats (see previous discussion under “Criteria for Defining Spotted Frog Populations”). We don't expect that activities beyond the one mile radius will negatively impact the extant spotted frog populations; analyses provided for the 5 and 10 mile radii provide comparison information and a perspective for the location of future development scenarios relative to occupied spotted frog habitats.

Table 7. Urban growth projections (acres developed) proximal to (1.0 mile, 5.0 mile, 10.0 mile radii) the Springville Hatchery/T-Bone Bottom spotted frog population, 2020 and 2050		
Mile(s) radius	Year 2020 Developed (% total area)	Year 2050 Developed (% total area)
1.0 mile	1,618 (8.1%)	1,621 (8.1%)
5.0 mile	14,488 (14.4%)	25,524 (25.4%)
10.0 mile	31,556 (15.7%)	65,100 (32.4%)

Hatchery operations also may result in direct mortality of spotted frogs that are caught in the hatchery water uptake system. However, this is not a significant threat because only one mortality has been documented (K. Wilson, UDWR, pers. comm.).

The presence of nonnative fishes, primarily mosquitofish and trout, is a potential threat to spotted frog eggs, tadpoles, and adults at the Springville Hatchery site. Raccoons also are present in this population of spotted frogs. However, spotted frogs have persisted long-term at this site in the presence of nonnative predators suggesting that this does not currently present an imminent threat to this population.

Conservation Actions

- The Springville Hatchery site is on State-owned land and is protected from further urban encroachment by a fenced enclosure.

Threat(s) addressed--urbanization.

- The UDWR carefully monitors and protects the water source. Since 1993, surface runoff from the surrounding developed lands has been diverted away from the site, and the habitat and water quality have improved. Techniques to protect the hatchery water intake from future potential disease and contaminant threats are currently being evaluated.

Threat(s) addressed--urbanization and subsequent runoff and contamination.

- Resource agencies are planning to implement methods to control water levels at the site and provide more stable, consistent spotted frog habitat.

Threat(s) to be addressed--drought conditions that decrease spring output.

Current and Foreseeable Status

The Springville Hatchery includes two breeding sites. Egg mass numbers at the long-term monitoring sites have fluctuated greatly and have decreased since 1999 (See Table 13; Wilson and Olsen 2001), compared to the highs recorded for 1997 (65 egg masses) and 1998 (87 egg masses). The recent decline in egg mass numbers is likely part of natural, cyclic population fluctuations, related to drought conditions (K. Wilson, UDWR, pers. comm., see Semlitsch 2002), and not indicative of long-range or future population trends. Spotted frogs have not been documented at T-Bone since 1996. Prior to this time, relatively few egg masses were observed at the one known breeding site (see Table 12 and Table 13; Wilson and Olsen 2001, UDWR unpubl. data).

Measures to remove and minimize the most imminent potential threats to this spotted frog population have been implemented and are ongoing. Habitat for the remaining portion of the population (Springville Hatchery) is protected in perpetuity, and measures to control potential contamination sources have been implemented. Efforts to improve and maintain water quality have been successful, and alleviate current threats associated with already existing development.

The T-Bone Bottom site is on private land currently unprotected from further urbanization although the landowner is not currently planning further development. The apparent disappearance of spotted frogs at this site is unexplained; repatriation of the site is a possibility for the future.

Despite the persistence of some threats and recent population declines, completed conservation actions have significantly alleviated the imminency of these and other potential threats. Removal of the imminent threats now allows efforts to focus on planning and implementation of restoration and possible expansion and reintroduction efforts in these locations. Recent interagency discussions have focused on the potential to augment and expand the range of the population by repatriating spotted frogs to other suitable spring habitats in the area (e.g., additional isolated ponds on UDWR, Springville Hatchery property). Increasing survivability of eggs and tadpoles by raising them in captivity ("head-starting"--see discussion under Fairview population) is planned for implementation in the spring of 2003.

Holladay Springs Population

The Holladay Springs population is located on private land in a valley west of Spring Lake near the town of Payson. Originally discovered in the 1980s (Ross et al. 1993), the site was first

described and evaluated during UDWR survey efforts (UDWR 1991). Habitat at this site consists of riparian wetlands and spring complexes consisting of several spring-fed ponds connected by a small stream.

Threats

Potential threats to the Holladay Springs spotted frog population include:

- agriculture
- livestock grazing
- nonnative predation
- urbanization

The Holladay Springs population of spotted frogs has been impacted by historical habitat loss and degradation from agricultural land practices and overgrazing by livestock (K. Wilson, UDWR, pers. comm.). Land-use practices including water diversion to support crop production, spring capping, and ditching have degraded wetlands that previously provided habitat and movement corridors for spotted frogs. Impacts from grazing, including bank trampling, loss of vegetation, and poor water quality are evident and severe in portions of the habitat. However, in many locations, livestock impacts to wetlands are significantly decreased by the availability of off-site water sources (K. Wilson, UDWR, pers. comm.). Despite these impacts, areas of quality habitat for this population of spotted frogs have persisted.

Holladay Springs and surrounding habitats have not been significantly impacted by urban development. Growth projections indicate that urban growth may expand into the Holladay Springs valley by 2050; however, development is not currently progressing in the valley. In fact, only five acres of development are projected to occur by 2020 within a one-mile radius of the population (Table 8). A distance of one mile from development is an appropriate analysis distance for impacts to the extant populations because spotted frogs are highly aquatic in nature and are typically found to move less than 500 m (0.3 mi) away from aquatic habitats (see previous discussion under “Criteria for Defining Spotted Frog Populations”). We don't expect that activities beyond the one mile radius will negatively impact the extant spotted frog populations; analyses provided for the 5 and 10 mile radii provide comparison information and a perspective for the location of future development scenarios relative to occupied spotted frog habitats.

Table 8. Urban growth projections (acres developed) proximal to (1.0 mile, 5.0 mile, 10.0 mile radii) the Holladay Springs spotted frog population, 2020 and 2050		
Mile(s) radius	Year 2020 Developed (% total area)	Year 2050 Developed (% total area)
1.0 mile	5 (0.02%)	2,001 (10.0%)

5.0 mile	2,530 (2.5%)	25,205 (25.1%)
10.0 mile	5,240 (2.6%)	53,948 (26.8%)

The presence of nonnative fishes, primarily mosquitofish, is a potential threat at Holladay Springs. Predation of spotted frog tadpoles by mosquitofish has been documented at this site (Chris Keleher, CUWCD, pers. comm). Raccoons also are present in the Holladay Springs. However, spotted frogs have persisted long-term at this site in the presence of nonnative predators suggesting that this does not currently present an imminent threat to this population.

Conservation Actions

- A HMP for this subunit, including the Holladay Springs population, is being developed by the UDWR (UDWR, unpubl. data). The plan will address required actions to protect and improve spotted frog habitat at Holladay Springs. Initial efforts will be focused on completing conservation easements and agreements with landowners to help remove poor land-use practices and initiate habitat improvements where necessary. Distribution surveys, habitat identification, and initial landowner contacts are ongoing in the Holladay Springs population. Preliminary contacts with landowners have been positive (K. Wilson, UDWR, pers. comm.). Similar plans for other spotted frog populations (i.e., Fairview) are completed, and have received funding from the State of Utah; similar success is expected for the Holladay Springs population.

Threat(s) to be addressed--urbanization, agriculture, nonnative predation, livestock grazing.

Current and Foreseeable Status

In 1994, there were two known breeding sites at Holladay Springs; however, two additional sites were identified in 1999 (see Table 12; UDWR 2002c, unpubl. data). Egg mass counts at the original long-term monitoring sites more than doubled between 1998 and 2000 (see Table 13; Wilson and Olsen 2001) compared to a low of 24 egg masses and a high of 64 egg masses documented from 1994 through 1997. Lower egg mass numbers were documented in 2001 and 2002; however, this is likely part of natural, cyclic population fluctuations related to climatic and drought conditions (K. Wilson, UDWR, pers. comm., see Semlitsch 2002), and not a measure of current or future population trends.

Surveys have located significant areas of suitable spotted frog habitat throughout the valley (UDWR, unpubl. data). Despite fragmentation from the aforementioned land uses, migration corridors still exist among known spotted frog locations within the Holladay Springs population (K. Wilson, UDWR, pers. comm.). Given that spotted frogs are currently known to inhabit only a small portion of the valley, there is the potential for discovering additional spotted frog locations. Furthermore, availability of suitable habitats and dispersal corridors near the extant population suggests that expansion of the current population may occur naturally (K. Wilson,

UDWR, pers. comm.).

Development, while projected to increase in the area, is not expected to expand significantly in the foreseeable future. Due to relatively low development pressure, completion of the conservation actions previously described has not been a priority until more imminent threats at other populations were reduced. While these conservation actions would benefit the Holladay Springs population, they are not essential for the current and long-term viability of the population.

Additional Conservation Actions in the Spanish Fork River Subunit

- In 2001, surveys for spotted frog populations and potential habitat were performed in 40 km² (15 mi²) of land through the Thistle Creek Valley to the confluence of Thistle Creek and the Spanish Fork River (UDWR, unpubl. data). No spotted frog egg masses, tadpoles, or adults were observed. However, these habitats were identified as suitable for potential spotted frog reintroduction.
- As previously described, a HMP for the Spanish Fork River Subunit is currently being developed by the UDWR (UDWR, unpubl. data). The HMP will address the distribution and protection of unoccupied suitable spotted frog habitats throughout the subunit, with a focus on the continued conservation of the Springville Hatchery/T-Bone Bottom and Holladay Springs populations.

PROVO RIVER SUBUNIT

The Provo River subunit encompasses the Provo River basin from its headwaters to Utah Lake. Spotted frogs are described in the historical literature as occurring along much of the Provo River (Tanner 1931, Turner 1960, Ross et al. 1993). Jordanelle/Francis and Heber Valley remain as extant populations in the Provo River subunit.

The Provo River has a long history of impacts by human activities. Water diversions and livestock grazing began with the arrival of the pioneers in the mid-1800s (Gourley and Allred 2002). By the 1930s, water diversions had dewatered some reaches of the Provo River. Water demands led to the construction of two major Federal water projects that affected the Provo River basin--the Provo River Project (PRP) and the Central Utah Project (CUP). Early PRP transbasin water diversions, including the Weber-Provo Canal, were in place in this basin as early as 1932; this canal diverted water from the Weber River into the upper Provo River. A second transbasin water diversion, the Duchesne Tunnel, was completed in 1954 to transport water from the Duchesne River basin into the upper Provo River. These water diversions have affected the Provo River corridor by increasing peak flows resulting in increased scouring, braiding, and channel instability (Gourley and Allred 2002). Beginning in the 1950s, significant physical channel alterations were initiated by the USBR and Provo River Water Users Association to increase or maintain water flow capacity. Portions of the Provo River channel continue to be altered to present day.

Spotted frogs have been negatively impacted by the construction of Deer Creek and Jordanelle Reservoirs on the middle Provo River. Deer Creek was built in 1941 just downstream of the Heber Valley as a part of the PRP; reservoir construction and operation likely resulted in the loss of an unknown number of spotted frogs and their habitat. Jordanelle Reservoir was completed on the middle Provo River as a part of the CUP in 1993. Spotted frogs found above, at, and below the future reservoir site were identified as the largest known population on the Wasatch Front at that time. Several spotted frog localities (“Jordanelle Reservoir” population; see Table 1), were discovered within the reservoir footprint as part of CUP survey efforts (UDWR 1991). The filling of Jordanelle Reservoir inundated an estimated 10 percent of the known spotted frog habitat on the Wasatch Front at that time (U.S. Fish and Wildlife Service 1993).

Most spotted frogs were found in what is now the Provo River arm of Jordanelle Reservoir in the Provo River bottoms and in association with Berg Springs (UDWR 1991). Spotted frogs were likely present throughout the Jordanelle basin but much of the suitable habitat was destroyed by reservoir construction (UDWR 1991). Relocation of these populations to habitats outside of the reservoir footprint was undertaken in conjunction with surveys of the Jordanelle basin in 1991. The relocation effort moved a total of 106 adults, 70 egg masses, and 36 tadpoles from 6 sites. Most of the frogs were relocated below the reservoir into ponds acquired by the USBR as mitigation for wetland losses from Jordanelle (now part of the Heber Valley population). Frogs found in riparian woodlands and marshes upstream of Berg Springs were thought to be above the high water mark and were not relocated. However, these populations were ultimately inundated.

In addition to physical loss of spotted frog habitat and populations, Deer Creek and Jordanelle Reservoirs permanently isolated spotted frog populations along the Provo River drainage. As a result, by the early 1990s there were three disjunct populations of spotted frogs-- Jordanelle/Francis (above Jordanelle Reservoir), Heber Valley (between Jordanelle and Deer Creek Reservoirs), and Wallsburg (up the Main Creek arm of Deer Creek Reservoir), in the Provo River drainage.

Jordanelle/Francis and Heber Valley are the only known extant populations within this subunit, and they are isolated from each other due to reservoir development. Initial spotted frog conservation efforts have focused on the Heber Valley population due, in large part, to immediate funding availability, and potential for large-scale successes. Increased conservation efforts now include the Jordanelle/Francis population.

Jordanelle/Francis Population

The Jordanelle/Francis population includes multiple spotted frog locations found along approximately 29 km (18 mi) of the Provo River above Jordanelle Reservoir in Wasatch County. Spotted frog habitat in this population consists primarily of beaver ponds with scattered riparian wetlands and springs. Land ownership is primarily (97 percent) private with a small portion (3 percent) under State ownership by Jordanelle State Park.

Threats

Potential threats to the Jordanelle/Francis spotted frog population include:

- livestock grazing
- nonnative predation
- water development
- urbanization

Development occurs only in localized areas (rural housing) along this section of the Provo River. Although Wasatch and Summit Counties are relatively unpopulated compared to the rest of the Wasatch Front counties, many areas of these counties, such as the upper Provo River, are desirable for residential and recreational development due to favorable climate, scenic views, and proximity to the urban centers of Salt Lake and Provo (Lee 2001). While this potential exists, the upper Provo River remains relatively undeveloped at this time.

Transbasin water diversions associated with PRP have significantly degraded the upper Provo River riparian and wetland habitats. Construction of the Provo/Weber Canal Diversion in 1932 diverted additional flows into the Provo River. The Duchesne Tunnel has diverted water from the Duchesne River into the Upper Provo River since 1954. Water diversions have increased peak flows resulting in increased scouring, braiding, and channel instability (Gourley and Allred 2002). Significant channel alterations, including dikes, berms, and physical modifications to the river substrate and banks, have been performed on the Provo River channel by the USBR and Provo River Water Users Association to increase or maintain water flow capacity (Gourley and Allred 2002).

Overgrazing along the upper Provo River since the mid-1900s (Gourley and Allred 2002) degraded spotted frog habitats. Grazing impacts have been most evident in the lower 5 miles of the river corridor (approximate location of Victory Ranch development proposal), except the State park lands just above Jordanelle Reservoir. Recent surveys indicate that spotted frog habitat use in the lower portion of this population has been restricted by grazing; most egg masses are restricted to the edges of heavily grazed pastures (Ammon 2002). Beaver eradication and associated destruction of beaver-created ponds and wetlands to improve livestock access have degraded and reduced spotted frog habitat in some locations (Ammon 2002). Spotted frog habitat consists predominantly of beaver ponds and riparian wetlands in upstream reaches. Grazing impacts have been less severe in upstream reaches because dense riparian vegetation inhibits cattle access (K. Wilson, UDWR, pers. comm.). Availability of off-site water sources have further alleviated grazing impacts in some portions of the upstream reaches.

Nonnative trout are present in this section of the Provo River. Because trout typically cannot access adjacent spotted frog habitats, they are not a significant threat. However, spotted frogs that attempt to use the river channel as a dispersal corridor may be predated. Raccoons also are present in the Jordanelle/Francis population. However, spotted frogs have persisted long-term at this site in the presence of nonnative predators suggesting that this does not currently present an

imminent threat to this population.

Conservation Actions

- The Victory Ranch Recreational Development is proposed along the lower 5 miles of the Provo River above Jordanelle Reservoir. As a part of this development, a golf course would be constructed in a portion of the floodplain of the Provo River. Although no direct impacts will occur to occupied spotted frog habitat, some direct effects to unoccupied potential habitat are planned and other indirect effects (e.g., decreased water quality) may occur in the project area. Through the permitting and review process, significant efforts have been made to avoid and mitigate for potential project impacts on spotted frogs. Although not complete to date, the developer has presented draft plans to the Corps, Service, and other resource agencies. Resource agencies are working with the landowner to acquire conservation easements to protect and enhance existing spotted frog habitat. These plans currently include donation of a conservation easement along approximately 8 km (5 mi) of the Provo River corridor where property has been appraised at \$30,000 per acre. These actions, despite some negative impacts from the golf course, will result in overall significant habitat improvements in the most degraded portion of this spotted frog population. Although this plan in and of itself does not offset past or potential future impacts to this population from other activities, the conservation efforts associated with this proposed project are anticipated to result in a considerable net benefit to this spotted frog population. If the project is permitted, these conservation actions are expected to be implemented and to benefit the Jordanelle/Francis population.

Threat(s) to be addressed--urbanization.

- The Victory Ranch mitigation proposal includes plans to reroute the Provo/Weber Canal to restore a more natural flow regime; remove artificial berms and dikes; and reconstruct floodplain habitat to provide increased spotted frog habitat (Gourley and Allred 2002). This project will result in significant improvement of spotted frog habitat in the restoration area.

Threat(s) to be addressed--water development, livestock grazing.

- As a part of the proposed Victory Ranch development, grazing will be removed from the entire river corridor and adjacent upland areas. Some habitats impacted by grazing will be enhanced with the proposed river restoration. Beaver control would be discontinued throughout most of the 8 km (5 mi) reach, allowing for natural creation of wetland habitats.

Threat(s) to be addressed--livestock grazing.

- Restoration of the Provo River associated with the proposed Victory Ranch development include plans to design spotted frog habitats that fish cannot access.

Threat(s) to be addressed--nonnative predators.

- A rural residence is proposed just upstream of the Victory Ranch Recreational Development. State and Federal agencies, in partnership with The Nature Conservancy and Utah Open Lands are negotiating a conservation easement to protect 7 ha (17 ac) of occupied spotted frog habitat.

Threat(s) to be addressed--urbanization, livestock grazing.

Current and Foreseeable Status

Egg mass counts at the Jordanelle/Francis long-term monitoring sites exhibited declines from 1994 to 1999; egg mass counts documented a high of 92 egg masses in 1994, steadily decreasing to a low of 20 egg masses in 1999. More recent data (1999 to 2002) reflects higher egg mass number at the original monitoring locations (see Table 13). More importantly, the discovery of previously unknown breeding sites in 2001 and 2002 indicates that original monitoring data considerably underestimated the potential reproductive output and viability of this population (see Table 12 and Table 13).

Recent surveys to more accurately establish population information have revealed that this population is more widely distributed than previously thought. In 1994, there were 14 known breeding sites along 10 km (6 mi) of the Provo River in the Jordanelle/Francis population; however, this number increased to 48 additional breeding sites identified during sweep surveys in 1999-2002 (see Table 12; UDWR 2002c, unpubl. data). This greatly expanded the known size of this spotted frog population by increasing the known occupied miles of the Provo River by approximately 19 km (12 mi). Four of the new sites are located on land owned by the USFS (Uinta and Wasatch-Cache Forests). Egg mass data indicate that the Jordanelle/Francis spotted frogs are exhibiting a stable to increasing population trend (Wilson and Olsen 2001).

The primary potential threat to this population is recreational and residential development. Development proposals with potential impacts to spotted frog habitats have only recently progressed in this area. Recent experience has shown that landowners and developers are willing to negotiate and implement actions beneficial to preservation and enhancement of spotted frog habitat.

Heber Valley Population

The Heber Valley population of spotted frogs occurs along approximately 16 km (10 mi) of the Provo River between Jordanelle and Deer Creek Reservoirs. Spotted frogs were first described from this location by Tanner (1931). A small portion of the population (5 percent) is located on private lands in the river corridor but outside of the mitigation properties. The Heber Valley represents the largest population of spotted frogs, comprising greater than half of the total estimated breeding population on the Wasatch Front.

Threats

A variety of factors have threatened the Heber Valley spotted frog population including:

- urban development
- agriculture
- livestock grazing
- water development
- nonnative predators
- disease

Recent conservation actions, including significant habitat restoration and protection, have removed most threats. In addition, urban development is not projected to occur within one mile of the Heber Valley population by 2050 (Table 9), minimizing the threat of indirect impacts that could affect water quality. A distance of one mile from development is an appropriate analysis distance for impacts to the extant populations because spotted frogs are highly aquatic in nature and are typically found to move less than 500 m (0.3 mi) away from aquatic habitats (see previous discussion under “Criteria for Defining Spotted Frog Populations”). We don't expect that activities beyond the one mile radius will negatively impact the extant spotted frog populations; analyses provided for the 5 and 10 mile radii provide comparison information and a perspective for the location of future development scenarios relative to occupied spotted frog habitats. Nonnative predators and disease remain as potential threats to the Heber Valley population.

Population	Mile(s) radius	Year 2020 Developed (% total area)	Year 2050 Developed (% total area)
Heber Valley	1.0 mile	0 (0%)	0 (0%)
	5.0 mile	2,843 (2.8%)	11,812 (11.8%)
	10.0 mile	8,925 (4.4%)	49,180 (24.4%)

In the fall of 2001, chytrid fungus was documented in five spotted frogs in the Heber Valley population; of the five, three frogs were found dead in the wild. Episodes of mass mortality, as experienced in other amphibian populations infected with chytrid, has not been observed in the Heber Valley population. The anticipated effect of chytrid infection in the Heber Valley spotted frogs, based on infection in other amphibian populations, could have been a significant decrease observed in the adult population in the spring 2002 (David Green, USGS, pers. comm); however, the 2002 spring monitoring data provided no evidence for an obvious crash in the adult population, based on egg mass numbers (UDWR, unpubl. data) and the ratio of salvaged carcasses to live frogs encountered (Elizabeth Ammon, UNR, pers. comm.).

The Provo River is inhabited by brown trout which are known to be highly predaceous. Although most spotted frog habitats in this area are not directly linked to the main river, connection may occur in some spotted frog wetlands during extreme high flow events (K. Wilson, UDWR, pers. comm.). Adult frogs may be predated if they attempt to use the river channel as a dispersal corridor. Raccoons also are present in the Heber Valley spotted frog population. Given the persistent increase in long-term population trends in the presence of nonnative predators, this is not an imminent threat at this time.

Conservation Actions

- The UDWR has implemented strict protocols to prevent the further spread of chytrid to other spotted frog populations. A monitoring program to detect the occurrence of chytrid in all spotted frog populations State-wide also has been implemented.

Threat(s) addressed--disease.

- Approximately 85 percent of the Provo River corridor (PRRP) has been acquired by the URMCC as partial mitigation for CUP impacts on fish and wildlife resources, including the spotted frog (URMCC 1998). The URMCC expects to complete acquisition of the remaining 15 percent of the corridor by 2004.

Threat(s) addressed--urbanization, agriculture, and livestock grazing.

- To date, the URMCC has created approximately 60-70 new wetlands along a 3-km (1.8-mi) reach of the Provo River corridor, the majority of which were constructed according to spotted frog habitat requirements (Elizabeth Ammon, UNR, pers. comm.). Beaver activity, which is not restricted or controlled in the PRRP river corridor, has created an additional 20 to 40 wetlands (Elizabeth Ammon, UNR, pers. comm.). Spotted frogs have colonized more than 40 of the newly created sites (spring 2002 data), and breeding has been documented in 15 of the wetlands. Since 1999, spotted frog breeding in the newly created sites have accounted for an average of 10 percent of the total egg mass production in this population (UDWR, unpubl. data). Completion of the PRRP ultimately includes plans for the creation of a total of 100 wetlands suitable for various life stages of the spotted frog.

Threat(s) addressed--urbanization, agriculture, grazing, and water development.

- In addition to CUP minimum stream flows of 125 cfs, the URMCC has acquired water shares/rights totaling 650 acre-feet for restoration areas in the PRRP that include spotted frog habitats (Mark Holden, URMCC, pers. comm.).

Threat(s) addressed--water development.

Spotted frog life history and habitat requirement studies are ongoing in the Heber Valley as part of the PRRP (Ammon and Wilson 2001), and include evaluations of:

1. Natural movement patterns of the spotted frog, including site fidelity, seasonal and inter-annual movement patterns, and travel distances;
2. Responses of the spotted frog to habitat creation including colonization behaviors and short- and long-term habitat uses; and
3. Responses of the adult and egg mass life stages of the spotted frog to relocation and repatriation.

Results of these studies have important implications for spotted frog management. For example, research results were used to create suitable wetlands for spotted frog habitat; spotted frog colonization has been successful in wetlands created with these criteria (Ammon and Wilson 2001). Habitat creation is now considered a potential method for recovery of spotted frog populations in some areas (Ammon and Wilson 2001).

Responses of spotted frog to relocation and repatriation along the PRRP also were evaluated (Ammon and Wilson 2001). In 1999 and 2000 a total of 45 adult spotted frogs were PIT-tagged and relocated. Recapture rates for these frogs has been low (13 percent), indicating that relocation of adult frogs may not be a viable means of expanding populations (Ammon and Wilson 2001). However, in 2000, 36 spotted frog egg masses were repatriated into unoccupied wetlands approximately 4.8 km (3 mi) upstream from the nearest occupied spotted frog site (Ammon and Wilson 2001). The repatriated egg masses hatched successfully, and the tadpoles reached adult stage by fall 2001. Egg masses were observed in the repatriation sites during the second year after repatriation (UDWR, unpubl. data). These results indicate that repatriation of egg masses may be a viable means of expanding spotted frog populations in this and other areas. Approximately 10 to 12 wetlands have been created in the direct vicinity of repatriation sites, and possible dispersal events into these sites will be closely monitored in the upcoming months.

Current and Foreseeable Status

Since 1994, egg mass counts at the original 22 long-term monitoring sites have been fluctuating, but stable (see Table 13; UDWR, unpubl. data). Expansion of spotted frogs into created and restored wetlands, in addition to previously unknown breeding sites discovered since 1996 have increased the number of known breeding sites in this population from a low of 22 (1994) to a high of 91 (2002) (see Table 12). Documented egg mass production in this population has increased by an average of 45 percent annually since 1995 (Wilson and Olsen 2001). These data indicate that the Heber Valley spotted frogs are exhibiting a stable to increasing population trend.

Threats from land-use activities have been essentially removed from the Heber Valley population due to the acquisition and restoration efforts associated with PRRP. The primary objective of the PRRP is to provide a more natural river ecosystem with improved river and riparian function between Jordanelle and Deer Creek reservoirs. The PRRP includes two main components--(1) acquisition of land along the Provo River corridor, and (2) restoration of altered and channelized sections of the Provo River (URMCC 1998). Habitat acquisition for the PRRP began in 1995. Approximately 250 ha (620 ac) have been acquired and an additional 200 ha (490 ac) are planned for future acquisition. Many of the lands targeted for acquisition provide occupied or potential habitat for spotted frogs. River reaches with the highest abundance of spotted frogs have already been acquired (Weland 2001). Management of the PRRP area will focus on maintenance of natural resources with low impact recreation opportunities (Weland 2001). Spotted frogs and their habitats are a conservation priority in the PRRP area, including habitat restoration, water acquisition, and research.

The potential lethality of chytrid infection is minimized in the Heber Valley because it is a highly protected, stable population. External stressors that are hypothesized as triggering or exacerbating infections (e.g., habitat degradation, predation) are minimized in this population by the protections and habitat enhancements taking place. At this time, absent any evidence of a negative effect on the population, chytrid fungus is not an imminent threat. Strict disease and monitoring protocols have been implemented to prevent further spread and closely assess this population for any indication of increased infection.

Continued research activities at PRRP will not only serve to improve long-term goals at Heber Valley, but also should benefit other spotted frog populations. Further results expected from these studies include the documentation of spotted frog survival in naturally dynamic riverine systems; identification of the breeding age of females; observations of the expansion and growth of repatriated populations; and further definition of appropriate spotted frog wetland design and creation techniques (e.g., number of wetlands to create, variation in microhabitats) (Ammon and Wilson 2001). In addition, a study of historic and current beaver activity in the restoration area, and how it may affect spotted frogs, is in progress (J. Rice, URMCC, pers. comm.).

UPPER WEBER RIVER SUBUNIT

The Upper Weber River subunit encompasses the upper Weber River drainage in Summit and Morgan Counties. This subunit consists largely of undeveloped high elevation habitats. However, some areas of urban and recreational development exist, including ongoing residential development and operation of several large ski resorts at Park City and surrounding areas. Given the scenic qualities and proximity to the heavily populated Wasatch Front, human population growth in this subunit is expected to dramatically increase over the next 20 years (Lee and Melcher 2001). This subunit also has been impacted by livestock grazing.

Records indicate that there were three historic spotted frog populations in this subunit (Table 1), none of which persisted into the early 1990s. Although recent surveys have not located any spotted frogs in this subunit, suitable habitat still exists (Thompson 1999).

Conservation Actions

- Survey efforts at several historic localities and other suitable spotted frog habitats throughout the subunit occurred during 1998-2002. No spotted frog egg masses, tadpoles, or adults were observed (UDWR, unpubl. data).
- The UDWR recently acquired property along 3.2 km (2 mi) of the Weber River between Echo and Rockport reservoirs for angler access (UDWR, unpubl. data; Paul Thompson, UDWR, pers. comm). This parcel includes riparian wetland habitats that are suitable spotted frog habitat. Habitat improvements, such as willow plantings, have been completed to improve and stabilize the stream and riparian conditions. Although spotted frogs do not occur in this area, the habitat is within the species historic range and may be suitable for future spotted frog reintroduction efforts (Paul Thompson, UDWR, pers. comm).

LOWER WEBER RIVER SUBUNIT

The Lower Weber River subunit consists of the lower Weber River drainage and other tributaries to the Great Salt Lake in Weber and Davis Counties. Impacts to potential spotted frog habitat in this subunit include significant urban development and livestock grazing. There are no historic records of the spotted frog in the Lower Weber River subunit. However, in 1996, a single adult spotted frog was collected by UDWR in Farmington Canyon (Perkins and Lentsch 1998). Subsequent surveys have not found any additional spotted frogs at this site (Thompson 1999). The status of a population in the Lower Weber River Drainage remains unclear and UDWR continues to survey these historic and potential habitats.

Conservation Actions

- Several survey efforts at historic localities and other suitable spotted frog habitats throughout the subunit occurred during 1998-2002. No spotted frog egg mass, tadpoles, or adults were observed (UDWR, unpubl. data).

JORDAN RIVER SUBUNIT

The Jordan River subunit includes the Jordan River from Utah Lake to the Great Salt Lake and tributaries draining the western slope of the Wasatch Mountains. This subunit is within the most heavily populated county in the State, Salt Lake (Lee 2001). Urban growth and infrastructure is dispersed throughout Salt Lake and Utah Counties and the remaining open lands are being rapidly converted to residential and industrial areas (Lee 2001). Records indicate that there were three documented historic spotted frog populations; the last known record of a spotted frog in this subunit was in 1968 (Bluffdale). Most historic spotted frog habitat at these locations has been eliminated by urban development; however, recent restoration projects along the Jordan River may provide suitable habitats for spotted frog reintroduction and range expansion efforts.

SEVIER RIVER GEOGRAPHIC MANAGEMENT UNIT

Description

The Sevier River GMU encompasses the southwest corner of the Bonneville Basin. The Sevier River basin drains the ranges and plateaus of south-central Utah. Elevation of the Sevier River GMU ranges from 1,520 to 3,050 m (5,000 to 10,000 ft). Historic and current records identify spotted frog occurrences along the San Pitch River. Spotted frogs are found only at lower elevations characterized by a more arid climate with low-elevation desert vegetation communities such as sagebrush or grassland meadows. Primary spotted frog habitat in this area includes spring complexes associated with the San Pitch River. Land use in this GMU is primarily agricultural including crop cultivation and livestock grazing.

The Sevier River GMU is divided into three subunits for spotted frog management (Perkins and Lentsch 1998)--San Pitch River, Middle Sevier River, and Lower Sevier River. It is believed that spotted frogs in the Sevier River GMU became naturally isolated from the other GMU populations following the decline of ancient Lake Bonneville (Perkins and Lentsch 1998). Human-caused fragmentation and isolation has occurred within the GMU.

SAN PITCH RIVER SUBUNIT

The San Pitch River subunit encompasses the San Pitch River basin as it drains into the Sevier River. Spotted frog habitat in the San Pitch River subunit is highly fragmented due to residential development; agricultural and livestock grazing practices; and water development projects. The only known record of spotted frogs is the current population at Fairview.

Fairview Population

The Fairview population of spotted frogs is found in the Sanpete Valley along the San Pitch River. Turner (1940) first described spotted frogs in the Fairview area as being “quite numerous.” Other records document spotted frog occurrences in the area from 1960 (Turner letter from 1981) and 1969 (Morris and Tanner 1969). Habitat consists of spring complexes on privately-owned agricultural lands scattered throughout the San Pitch Valley. In 1994, spotted frogs were known to breed at 11 sites in the valley; these sites were established as monitoring locations.

Threats

Potential threats to the Fairview spotted frog population include:

- residential development
- agriculture
- livestock grazing
- nonnative predators

The Fairview spotted frog population is naturally isolated from all other spotted frog populations on the Wasatch Front due to the geographic separation of the San Pitch River Valley; however, habitat degradation from residential development and agricultural activities has fragmented spotted frog locations within this population (Wilson and Balcomb 2001). Historically comprised of one connected population, the Fairview population is now separated into northern and southern segments. Overland migration of spotted frogs between the northern and southern segments is only possible during extremely wet years, except for limited potential dispersal via the San Pitch River (K. Wilson, UDWR, pers. comm.).

Water diversion to support crop production, spring capping, and ditching has degraded wetlands that previously provided habitat and dispersal corridors for spotted frogs (Wilson and Balcomb 2001; K. Wilson, UDWR, pers. comm.). Agricultural fields have further fragmented the southern segment into three management areas. Residential development associated with the town of Fairview also eliminated and fragmented spotted frog habitats.

Habitat degradation from livestock overgrazing, and water quality degradation from increased siltation and nutrient loading is evident in portions of the Fairview population (Hogrefe 2000, Wilson and Balcomb 2001). Impacts such as bank trampling and reduced riparian vegetation are significant in 5 of the 26 known spotted frog breeding sites (K. Wilson, UDWR, pers. comm.).

The San Pitch River is inhabited by brown trout which are known to be highly predaceous. Although most spotted frog habitats in this area are not directly linked to the main river, connection may occur in some spotted frog wetlands during extreme high flow events (K. Wilson, UDWR, pers. comm.). Adult frogs may be predated if they attempt to use the river channel as a dispersal corridor. Trout are known to inhabit one pond that spotted frogs frequently use for breeding. Raccoons also are present in the Fairview spotted frog population. Given the persistent increase in long-term population trends in the presence of nonnative predators, this is not an imminent threat at this time.

Conservation Actions

- A HMP for the spotted frog in the San Pitch River subunit has been finalized (Wilson and Balcomb 2001). Plan guidance focuses on protection and improvement of current and potential habitats, including preservation of dispersal corridors. Development of a population augmentation (“head-starting”) program, egg mass relocation effort, and predator control programs (Wilson and Balcomb 2001) are planned. Actions taken to protect spotted frogs in the San Pitch Valley are guided by this HMP, and include:

Threat(s) addressed--all.

- The UDWR has approached local landowners to develop conservation easements for the spotted frog; initial landowner responses have been positive. Negotiations for conservation easements with seven landowners are ongoing (K. Wilson, UDWR, pers. comm). Completion of these easements will protect approximately 162 ha (400 ac) of occupied

spotted frog habitat in perpetuity.

Threat(s) to be addressed--residential development, agriculture, and grazing.

- Spotted frog habitats that exhibit livestock grazing impacts have been identified in the Fairview area (K. Wilson, UDWR, pers. comm). Many of these areas are in parcels currently under negotiation for conservation easements. Completion of the easements will include management plans for grazing, and appropriate habitat modifications and improvements.

Threat(s) to be addressed--livestock grazing.

- Spotted frog breeding sites are monitored each year and egg masses that have been deposited in areas where successful metamorphosis to adults is unlikely (i.e., low water conditions) are moved to more suitable sites.

Threat(s) addressed--agriculture, livestock grazing.

- Additional habitat protection is being negotiated along with a proposed wastewater treatment plant in the San Pitch Valley near Fairview. Thus far, the Service, the Corps, and UDWR have worked with the applicant to relocate the proposed plant outside of spotted frog habitat. Although not complete to date, the applicant is proposing to donate approximately 1.6 ha (4 ac) of mixed uplands and wetlands for a conservation easement for spotted frogs as a part of the project.

Threat(s) to be addressed--residential development.

- Methodologies for population augmentation (“head-starting”) programs are being evaluated and could also be used in other spotted frog populations if determined feasible in Fairview.

Current and Foreseeable Status

Egg mass numbers at the Fairview long-term monitoring sites have fluctuated, but have remained relatively stable (see Table 13; Wilson and Balcomb 2001). Lower egg mass numbers were documented in 2001 and 2002; however, this is likely part of natural, cyclic population fluctuations related to climatic and drought conditions (K. Wilson, UDWR, pers. comm., see Semlitsch 2002), and not a measure of current or future population trends. Sweep surveys performed in 1999 and 2000 located an additional 15 spotted frog breeding sites (see Table 12) along the San Pitch River which considerably increased the known egg mass numbers and the known density of habitat occupied by spotted frogs in this population (Wilson and Balcomb 2001, UDWR 2002c). These data indicate that the Fairview spotted frogs are exhibiting a stable population trend and are more widely distributed than previously thought.

The Fairview population has recently begun to receive more attention for spotted frog conservation efforts. The potential for urbanization has been relatively low, based on growth projections (Lee 2001). Therefore, conservation efforts were initially more focused on other, more imminently threatened spotted frog populations. However, there is the potential to improve habitats and expand spotted frog populations in the Fairview area through ongoing cooperation and development of conservation easements.

Middle Sevier River Subunit

The Middle Sevier River subunit comprises the Sevier River basin from Piute Reservoir down stream to Yuba Reservoir. There are no historic records of spotted frogs occurring in this subunit and there are no current populations. Potential spotted frog habitats are surveyed by UDWR as part of ongoing regional amphibian studies (K. Wheeler, UDWR, pers. comm.).

Lower Sevier River Subunit

The Lower Sevier River subunit consists of the Sevier River basin downstream from Yuba Reservoir. There are no historic records of spotted frogs occurring in this subunit and there are no current populations. The best potential spotted frog habitat in this subunit is a large spring complex directly adjacent to the Sevier River, just north of Yuba Reservoir in the Mills Valley. Other potential spotted frog habitats are surveyed by UDWR as part of ongoing regional amphibian studies (K. Wheeler, UDWR, pers. comm.).

e. Conservation Actions Occurring State-wide that Benefit the Wasatch Front Spotted Frog

Site-specific conservation actions were previously discussed for each population and population. The following conservation actions are occurring State-wide that will benefit the Wasatch Front spotted frog:

Nonnative Control

The UDWR is developing a MOU with the county mosquito abatement districts governing the stocking of mosquitofish State-wide. This MOU will establish State-wide protocols and procedures for the collection, propagation, transport, distribution, and release of mosquitofish, to help prevent further introductions into spotted frog habitats (UDWR 2002a).

Research

Outside of the PRRP studies in the Heber Valley, other research on spotted frog is ongoing. In 2000, Utah State University initiated an investigation of the habitat associations of the spotted frog in Utah (Hogrefe 2000). This study compares occupied habitat to the distribution of available habitat, and identifies characteristics that could enhance or limit survival of the species. Analyses at four spatial scales will be conducted across the State to identify regional differences.

Habitat parameters such as water chemistry, vegetation, and wetland size will be used to characterize State-wide habitat associations of the spotted frog. Habitat associations for specific populations (Fairview, Mona Springs Complex/Burraston Ponds, and Heber Valley) also will be evaluated.

Genetic Analysis

Recent genetic analyses studies (Green et al. 1996, Green et al. 1997) have been the basis of taxonomic changes for the spotted frog in Utah. Spotted frog populations occurring within Utah are now taxonomically described as *Rana luteiventris*. Additional studies (Toline and Seitz 1999, Bos and Sites 2001) were completed to assess the genetic relationships and distribution of spotted frog populations in Utah and range-wide (see previous discussion under “Systematics and Taxonomy”).

Range Expansion

The URMCC’s State-wide plans include a component for Fish Hatchery Improvements and Construction (Weland 2001). A Fish Hatchery and Production Plan was originally written in 1994, but revised in 1998 to include the requirements for culture and production of spotted frog for population augmentation and reintroduction within the species historic range in Utah. In partnership with the UDWR, the Service, BLM, and DOI, a study evaluating the goals and rearing requirements for a native species culture facility. The native species hatchery is currently undergoing National Environmental Policy Act (NEPA) analysis; design and construction is expected to begin in 2003, and the facility is expected to be operational by 2005.

Spotted Frog Conservation Agreement and Strategy

The Agreement was signed in 1998 by the UDWR, Service, BLM, USFS, URMCC, USBR, Goshute Tribe, and the CUWCD. The goal of this Agreement is to ensure the long-term conservation of spotted frogs within their historical range in Utah. The Agreement provides a mechanism for the conservation and management of the spotted frog by establishing a framework for interagency cooperation and coordination of conservation efforts and development of recovery priorities. Since 1998, the Agreement significantly increased awareness for the spotted frog; numerous actions for the protection and enhancement of spotted frogs and their habitat have been subsequently completed or initiated. Today, spotted frog conservation is one of the most prominent considerations in management of fish and wildlife resources on the Wasatch Front.

VII. SUMMARY OF FACTORS AFFECTING THE SPECIES

A species may be determined to be an endangered or threatened species due to one or more of the following five factors described in section 4(a)(1) of the Act. These factors and their application to the Wasatch Front spotted frog are as follows:

- A. The present or threatened destruction, modification or curtailment of its habitat or range;
- B. Overutilization for commercial, recreational, scientific, or educational purposes;
- C. Disease or predation;
- D. The inadequacy of existing regulatory mechanisms;
- E. Other natural or manmade factors affecting its continued existence.

In the following section, the threats and issues that are of most concern to the Wasatch Front spotted frog are evaluated for each listing factor:

A. The Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range.

Urban growth, water development, and subsequent losses of wetland and spring habitats were the primary causes for historical population losses and habitat fragmentation for the spotted frog on the Wasatch Front. Continued urbanization has been identified as a potential cause of concern for the spotted frog based on human population growth projections. The Wasatch Front human population is projected to increase to almost 3 million by 2020 and 5 million by 2050 (Lee 2001). Counties with extant populations of spotted frogs are experiencing high human population growth rates (Table 10).

Approximately 14,400 ha (35,500 ac) of wetland habitats are at direct risk from urban expansion by 2050 (Lee 2001, Lee and Melcher 2001). However, development is not projected to substantially increase near (within 1.0 mile) most extant spotted frog populations until at least 2050. For example, there are only 5 acres and 62 acres projected to occur, respectively, within 1.0 mile of the Heber Valley and Holladay Springs populations by 2020. A distance of one mile from development is an appropriate analysis distance for impacts to the extant populations because spotted frogs are highly aquatic in nature and are typically found to move less than 500 m (0.3 mi) away from aquatic habitats (see previous discussion under “Criteria for Defining Spotted Frog Populations”). We don't expect that activities beyond the one mile radius will negatively impact the extant spotted frog populations; analyses provided for the 5 and 10 mile radii provide comparison information and a perspective for the location of future development scenarios relative to occupied spotted frog habitats. Urban development is not projected to occur in the vicinity of the Jordanelle/Francis population; however, recreational and rural residential development is increasing in the area and will likely continue. However, in and of themselves, general predictions about the degree of urbanization and other land uses in 2050 are too distant in time and speculative in nature to support a finding that the spotted frog is likely in the foreseeable future to be in danger of extinction. And while three of the populations faced more certain and immediate threats to their habitat, as discussed below, those threats have been

sufficiently addressed by conservation actions currently in place.

Table 10. Projected Annual Growth Rates of the Human Population in Counties with Extant Populations of Spotted Frog.

County	Growth Rate (%)
Utah	3.8
Wasatch	4.2
Summit	6.7
Juab	4.2
Sanpete	3.9

Note: Growth rates taken from Lee 2001 except for Summit County which was obtained from the web site, URL: <http://utahreach.usu.edu/summit/visitor/about.html>.

Recent conservation and management efforts (Table 2) have successfully focused on addressing foreseeable habitat loss threats to an extent that alleviates the threat of urbanization at the extant populations. Water development was identified as negatively impacting spotted frog habitat in the Heber Valley; however, this threat was removed with the purchase of 125 cubic feet per second of riverine base flows and 650 acre-feet of water for restored habitats under the Provo River Restoration Project. A potential threat to the Mona/Burraston population of spotted frogs is groundwater withdrawals in the Juab Valley. Thiros (1999) estimated, using estimated 1992 water withdrawal rates, and assuming no additional water contributions to the system, the water table could be lowered by 1.5 m (5 ft) and groundwater discharge rates reduced by 38 percent by 2022; however, model predictions indicate that the available groundwater levels to support wetland vegetation is not predicted to significantly decrease in the Mona/Burraston area and habitat for this population of spotted frogs may not be affected (Thiros 1999). Groundwater levels are currently sufficient to sustain the Mona/Burraston spotted frog population. Early identification and understanding of this potential problem provides adequate time for resource agencies to identify and implement mechanisms to address the issue before it becomes a threat to this population. Habitat acquisitions or easements have been completed to a large degree at three (Mona/Burraston, Heber Valley, Springville Hatchery) of the extant populations to protect the populations in perpetuity. For example, 85 percent of the Provo River corridor in the Heber Valley (including most occupied spotted frog habitat) has been purchased through conservation efforts and is protected in perpetuity through legally binding agreements. Because of this protection, urbanization is no longer a direct threat to these populations. Although the threats to the habitat of other populations are distant and speculative at this time, as discussed below in “Recommendations for the Future,” similar protection efforts are planned for those populations.

Due in part to completed and ongoing habitat protection and conservation activities put in place

during the past 5 years, the long-term viability of the extant spotted frog populations on the Wasatch Front is stable to increasing. Recent survey efforts have discovered new breeding sites over larger areas, and documented larger population sizes than were previously known. The extant populations are more extensive, more connected and, therefore, more viable than previously thought.

Completion of habitat protection activities and subsequent reduction of imminent threats to the extant populations allows conservation efforts to focus on population expansion into historic, unoccupied habitats. Habitat protection and reintroduction of frogs into suitable, unoccupied habitats will further improve the long-term status of the species along the Wasatch Front. For example, recent habitat acquisitions that also will benefit the spotted frog include 5,544 ha (13,700 ac) at Utah Lake and 3.2 km (2 mi) along the upper Weber River.

Although habitat acquisitions that are completed are sufficient to address the current threats to the Wasatch Front population of spotted frog, efforts continue for acquiring additional habitats. Habitat acquisitions, to date, were targeted in those populations where threats were the most imminent. Potential threats are minimal at the remaining unprotected populations and do not compromise the long-term persistence of the spotted frog.

Given the habitat protection already in place, habitat loss is not likely to put the frog in danger of extinction in the foreseeable future. This is so even if none of the additional planned habitat protection is completed. To the extent that the additional protection is completed, it should further improve the status of spotted frog.

Table 11. Habitat Protection at Extant Spotted Frog Populations.

Subunit or Population	Habitat Quantity	Acquisition or Easement	Habitat Type	Purchase Status
Springville Hatchery	22.3 ha (55 ac)	Acquisition (State fish hatchery)	Occupied spring complex	Completed
Mona/Burraston	34.6 ha (85.5 ac)	Acquisition	Occupied spring complex	Completed
Mona/Burraston	7.9 ha (19.5 ac)	Acquisition or Easement	Occupied spring complex	Ongoing
Heber Valley	251 ha (620 ac)	Acquisition	Occupied riparian wetlands	Completed
Heber Valley	198 ha (490 ac)	Acquisition	Occupied riparian wetlands	Ongoing
Heber Valley	650 acre-feet (plus 125 cfs base flows)	Acquisition	Stream flows to occupied riparian wetlands	Completed
Jordanelle/Francis	9.7 km (6 mi) 6.5 ha (16 ac)	Easement	Occupied riparian wetlands	Ongoing
Fairview	~ 162 ha (400 ac)	Easement	Occupied spring complex	Ongoing
Utah Lake	5544 ha (13,700 ac) (includes previously acquired lands)	Acquisition	Unoccupied spring complexes	Completed
Weber River	3.2 km (2 mi)	Acquisition	Unoccupied riparian wetlands	Completed

* A full list of all actions since 1998 (e.g., habitat enhancements, surveys, conservation easements) is in the appendix of this Status Review.

B. Overutilization for Commercial, Recreational, Scientific, or Educational Purposes.

The collection of spotted frogs is currently prohibited (State of Utah Rule R657-3). However, past collections of this species may have contributed to the extirpation of some populations on the Wasatch Front. In particular, spotted frogs were collected from the Provo, Springdell, and Vivian Park areas for universities (U.S. Fish and Wildlife Service 1993).

Past and ongoing studies on the life history and habitat requirements of spotted frog in Heber Valley include the use of radio-tags, PIT-tags, and general handling of individual frogs. However, there have been no documented injuries or mortalities due to research related activities (e.g., handling stress). Although these actions may increase the stress, disease risk, and mortality in this population, these studies are not a significant threat with the operating protocols and procedures to limit potential impacts in place.

C. Disease or Predation.

Predation

Predation by introduced species is a potential threat to the Wasatch Front spotted frog. Most spotted frog habitats in Utah were not historically inhabited by predatory fish species (Sigler and Miller 1963). Today, a variety of introduced fishes, including largemouth bass, rainbow trout, brown trout, brook trout, common carp, mosquitofish, and rainwater killifish have become established in spotted frog habitats on the Wasatch Front. The potential threat appears highest from mosquitofish due to its affinity for the same systems as the spotted frog.

The mosquitofish (*Gambusia affinis*) is a small fish native to the eastern and southeastern United States. This species has been stocked throughout the world as a means of biological control for mosquitos (Sigler and Sigler 1996). Mosquito abatement districts have extensively stocked mosquitofish throughout various aquatic habitats in Utah including wetlands that have current or historic populations of spotted frog. Mosquitofish may be illegally transferred to new habitats by the general public or inadvertently transferred during relocation and reintroduction efforts for other aquatic species. Once introduced, mosquitofish can migrate to adjacent habitats.

Mosquitofish pose a potential threat to spotted frogs because of their known aggressive predation on eggs and young of fishes and amphibians (Grubb 1972, Sigler and Sigler 1987). Mosquitofish are suspected to prey preferentially on amphibian larvae in the presence of other potential prey items (Goodsell and Kats 1999). Spotted frogs may be particularly susceptible to predation by mosquitofish because the frogs emerge from the egg at a very small size of 8-10 mm (Morris and Tanner 1969). Studies of the California red-legged frog (*Rana aurora draytonii*) showed that tadpoles of all sizes may be susceptible to mosquitofish predation; they found that mosquitofish were effective predators on tadpoles and could injure or kill tadpoles larger than themselves (Courtenay and Meffe 1989). Spotted frog larvae are unable to swim for a few days after hatching, thus inhibiting their ability to actively avoid predation (Morris and

Tanner 1969).

Mosquitofish have been observed preying on recently emerged spotted frog tadpoles in populations on the Wasatch Front (Ross et al. 1993; Chris Keleher, CUWCD, pers. comm.).

Raccoons expanded their range into Utah over the past 25 years (Wilson and Balcomb 2001). Raccoon predation has been documented in the Heber Valley (K. Wilson, UDWR, pers. comm.). Although they are amphibian predators, the level of threat to the Wasatch Front spotted frog has not been determined. Bullfrogs, another nonnative predator, are also expanding their range into the Wasatch Front, but have not been documented in any spotted frog populations.

To date, no spotted frog extirpations have been attributed to the presence of nonnative species. Population-level effects (i.e., population declines due to predation) by mosquitofish, and other predators, have not been observed on the Wasatch Front (K. Wilson pers. comm.). Available information suggests that spotted frogs are persisting with the presence of nonnative species. Extant spotted frog populations are stable to increasing.

Habitat protection and research efforts are continuing to explore control methodologies in the event that nonnative species could ultimately affect spotted frog populations. For example, newly created and restored habitats at Heber Valley and Jordanelle/Francis are being designed to prevent nonnative species invasions. Ongoing conservation actions at all occupied habitats include assessing the impacts of nonnative species on the spotted frog and active removal in some cases. For example, a mechanical removal effort targeting nonnative fish species (primarily mosquitofish) has been underway since 1999. Long-term reduction of mosquitofish was not achieved; however, the documented temporary reduction has important implications toward substantially reducing mosquitofish numbers during critical life-stages of spotted frog (recently emerged tadpoles) and allowing better recruitment of spotted frog to adult life-stages (UDWR, unpubl.data). Given the known level of impact and the above-described conservation actions and protocols, predation by nonnative species does not threaten the persistence of Wasatch Front spotted frog populations.

Disease

Chytrid fungus was recently discovered in the Heber Valley population of the spotted frog (Green and Converse 2002, Green and Sohn 2002). Chytrid fungus has been implicated in precipitous declines of amphibian species worldwide (Berger et al. 1998, Longcore et al. 1999, Fellers et al. 2001, NWHC 2001). However, its role in the larger picture of frog population dynamics, and more importantly, its implications for the spotted frog remains undefined. In fact, questions remain regarding the actual infection rate of chytrid in wild populations (Sredl 2000). Some researchers now speculate that the distribution and infection rate of chytrid may reflect more the extent to which biologists have tested for it as much as it reflects the actual distribution of infection (Fellers et al. 2001). Chytrid fungus may naturally occur in many amphibian

populations that are only affected when other stressors or environmental factors interact synergistically to increase the virulence of the disease or compromise amphibian immune systems (Carey et al. 1999, Lips 1999). Some frog populations are known to have coexisted with chytrid fungus for decades (USFWS 2002).

Some researchers speculate that the spotted frog may exhibit a resistance (David Green pers. comm. 2002) or adapt (Green and Converse 2002, Green and Sohn 2002) to chytrid infection. Evidence suggests that amphibians infected with chytrid frequently die of dehydration because alteration of the skin inhibits their ability to absorb water. This is especially true in toads which, as opposed to frogs, have a limited area of skin over which to uptake water (i.e., the pelvic patch); chytrid die-offs have been seen much less frequently in more aquatic amphibians, such as salamanders. Researchers hypothesize that frogs avoid death by dehydration from chytrid infection because they more freely exchange water through skin over a large portion of their body. In this sense, spotted frogs, because they are highly aquatic in nature, may exhibit a similar “resistance” to chytrid infection (David Green pers. comm. 2002). The infected Heber Valley frogs exhibited a limited infection with chytrid present only on the toes; these individuals appeared to control and adapt to their chytrid infections (Green and Converse 2002, Green and Sohn 2002). The chytrid researchers believe that low-stress conditions in the laboratory may have allowed these spotted frogs to persist long after infection was detected.

The Heber Valley population is the largest and most protected spotted frog population on the Wasatch Front. Habitat protection and conservation efforts have minimized or removed potential threats such as urbanization, predation, and water depletion as stressors from this population. Based on available information, the Heber Valley frogs are less likely to incur large-scale die-offs and are more likely to coexist with chytrid fungus in this low-stress environment. To prevent the potential for further spread of chytrid and other potential disease risks for spotted frogs, the UDWR has implemented strict disease protocols for managers and researchers working with spotted frog and other aquatic species in Utah. Implementation of these procedures is expected to greatly decrease the potential for chytrid to spread to other spotted frog populations. However, all Wasatch Front spotted frog populations will be closely monitored to identify any potential effects of chytrid.

Our current understanding and the relatively low level of known infection of chytrid fungus provides a measure of assurance that the current infection will not put the spotted frog in danger of extinction. To ensure the accuracy of this analysis, efforts will continue to document and control the spread of chytrid fungus.

D. The Inadequacy of Existing Regulatory Mechanisms.

Regulatory mechanisms did not halt the historical decline of the spotted frog along the Wasatch Front. However, historically, this was largely due to a lack of knowledge regarding the declining status of the spotted frog. Beginning in the mid-1990s, conservation of the spotted frog became a focus of many State and Federal agency efforts, resulting with implementation of the interagency Agreement and long-term protection for extant spotted frog populations.

Importantly, the extant populations are now largely protected from imminent threats and there are ongoing conservation actions aimed at providing long-term protection for unoccupied habitats.

Existing regulatory mechanisms that also may provide protection for spotted frogs and their habitats include--(1) State laws, (2) NEPA, and (3) section 404 of the Clean Water Act. These laws provide additional protection and awareness above and beyond completed and ongoing conservation efforts.

State Regulations

The spotted frog is currently designated as a sensitive species in the State of Utah and is managed under an Agreement. State of Utah Rule 657-3 regulates the collection, importation, and possession of spotted frogs. The State of Utah Fish Stocking and Transfer Procedures (Policy # W2ADM-1) protects the spotted frog and other sensitive species in Utah by preventing the stocking of nonnative and other potentially harmful species in spotted frog habitats, and outlining protocols to decrease potential transmission of harmful pathogens in to spotted frog populations.

National Environmental Policy Act

The NEPA requires Federal agencies to describe a proposed action, consider alternatives, identify and disclose potential environmental impacts of each alternative, and involve the public in the decision-making process. Federal agencies are not required to select the alternative having the least significant environmental impacts but environmental impacts, including those to wetlands and wildlife, are included as part of the public review process and NEPA analysis.

The NEPA can be an effective mechanism in the conservation of spotted frog where a Federal nexus exists, and agencies are actively involved in spotted frog conservation (i.e., the Agreement provides a mechanism for coordination and awareness in this regard). Land use and activities on private lands which includes more than half of the spotted frog populations are not required to comply with NEPA. Many large-scale land activities and water development projects occurred before there was a local awareness about the historically declining status of the spotted frog. However, most Federal agencies with interest or planned actions that might affect spotted frog are currently signatories to the Agreement. Although their involvement in and of itself does not legally bind the signatories to specific actions under NEPA, since the inception of the Agreement, these agencies have included spotted frog impacts and conservation as part of NEPA compliance.

Clean Water Act Section 404

Section 404 of the Clean Water Act, administered by the EPA and Corps, is the primary Federal law that potentially provides protection for the spotted frog by regulating fill to wetlands and other aquatic habitats determined to be jurisdictional, in part through proximity to surface water connection. The types of wetland impacts addressed by section 404 include:

- (1) Actions that impact jurisdictional wetlands defined as “waters of the United States,” 33 U.S.C. § 1363(7);
- (2) Discharge of dredged or fill material into waters of the United States; and
- (3) Limited activities in upland habitats that may have indirect impacts on adjacent to wetlands where fill is permitted.

Recent court decisions, [National Mining Association et al., v. U.S. Army Corps of Engineers 145 F.3d-1399 (D.C. Cir. 1998) (overturing the Tulloch Rule); Solid Waste Agency of Northern Cook County v. United States Army Corps of Engineers 531 U.S. 159 (narrowing the definition of waters of the United States)] have recently reduced the authority of section 404 to protect wetland habitats.

Because of their hydrologic connection to navigable waterways (e.g., Provo River, San Pitch River), the Corps still regulates the remaining unprotected remnant spotted frog wetland areas and large areas of unoccupied habitats. The Service maintains an important advisory role to the Corps in the Section 404 permitting process. Because of questions concerning the success of spotted frog translocations and spotted frog habitat creation, recent discussions with the Corps have focused on using habitat protection (acquisitions, easements) and restoration techniques for mitigation of spotted frog habitats where necessary.

Resource agencies have been successful at incorporating actions and project conditions that protect and enhance spotted frog habitat. Ongoing efforts include the protection and restoration of spotted frog habitat along the upper Provo River associated with the proposed Victory Ranch development and planned acquisitions of other properties along the Upper Provo River. In addition, ongoing negotiations have been successful in relocating a proposed wastewater treatment plant in the San Pitch Valley near Fairview to a location outside of spotted frog habitat. Furthermore, the applicant is proposing to donate approximately 1.6 ha (4 ac) of mixed uplands and wetlands for a conservation easement for spotted frogs as a part of the project.

Some areas of unoccupied habitats may be considered nonjurisdictional (i.e., not subject to regulation under section 404). However, a large portion of remaining unoccupied habitats are not imminently threatened; and, in fact, unoccupied suitable habitats at Utah Lake and the Weber River are protected in perpetuity. Unoccupied habitats are important for future reintroduction

and range expansion efforts now that the extant populations are stable. Although there are no documented records of spotted frogs in these areas, Utah Lake and the Weber River fall within its historic range and provide presumably suitable habitat.

In summary, section 404 certainly does not provide complete protection for the spotted frog and its habitats. Historically, regulatory inadequacies likely resulted in the loss of large amounts of occupied spotted frog habitats. Agencies have more recently been successful in working with local landowners and the 404 permitting process to protect and restore spotted frog populations and habitat. The cooperative environment that has resulted from the Conservation Agreement has facilitated efforts to prioritize the spotted frog through the section 404 permitting process. Because of this emphasis, actions that could affect occupied spotted frog habitats are more thoroughly evaluated and efforts are made to avoid or minimize potential impacts. Therefore, potential regulatory inadequacies do not threaten the long-term persistence of the Wasatch Front spotted frog.

E. Other Natural or Manmade Factors Affecting its Continued Existence.

Drought may play a role in reducing reproduction of spotted frogs on the Wasatch Front; adult frogs may forgo breeding when conditions are unfavorable (Twitty 1966, Semlitsch et al. 1996). Furthermore, diminished availability of breeding habitat and growth of metamorphs may exhibit short-term immediate fluctuations with decreased precipitation (Semlitsch 2002). Decreased rain and snowfall can also dry wetlands, desiccate spotted frog egg masses and larvae, and reduce survival rates of subadults and adults (U.S. Fish and Wildlife Service 2000). However, amphibians are also explosive breeders and populations frequently experience years of extremely high reproductive success when conditions, such as precipitation, are more advantageous (Semlitsch 2002).

Drought conditions during the past few years may have reduced available resources for frogs in the summer and fall, likely resulting in reduced egg formation in pre-hibernating females and subsequent reductions in egg masses observed (see Table 13). However, given the highly variable nature of amphibian populations in response to changing climate conditions (Semlitsch 2002), the short-term egg mass reductions in conjunction with sporadic climate conditions do not necessarily equate to long-term population-level decreases (Wilson and Olsen 2001).

Contaminants have not been specifically implicated in the decline of any spotted frog population on the Wasatch Front. However, given the prevalence of agriculture and urban development, the species is likely exposed to a variety of toxins from urban and agricultural sources. While the sensitivity of this species is largely unknown, studies of similar amphibian species show sublethal and lethal effects at the population level.

These factors are not currently known to be significant threats to the long-term persistence of the Wasatch Front spotted frog.

VIII. CONCLUSIONS AND FINDINGS

Historic Status and Trends

As previously discussed, spotted frogs likely inhabited a large portion of the suitable habitat in this region, and there were likely many more populations and greater habitat connectivity historically than what is documented today. Populations have been documented in the past century by various sources. Although data are limited, available historic and recent information indicates there was a decline in the number of spotted frog populations along the Wasatch Front through the early- to mid-1900s. In fact, some experts speculated that the Wasatch Front spotted frog was extinct by the 1980s due to losses of known populations in some areas and widespread human development and land-use (Hovingh 1987, UDWR 1991).

Historical habitat loss and degradation also resulted in the current isolation of extant populations. It is difficult to determine to what extent known populations may have been connected in recent history. The Utah Lake drainage may have been comprised of interconnected wetland, spring, or marsh habitats that provided dispersal corridors among populations of spotted frogs in the Provo, Spanish Fork, and Utah Lake subunits. However, the extent of their temporal and spatial connection is unknown. Given the great distances between some populations (e.g., between Holladay Springs and Springville/T-Bone), it is likely that there was little genetic interchange even in recent history. Undoubtedly, some existing populations were fragmented or further isolated from each other with extirpation of populations due to human activities such as habitat loss and water development (e.g., Jordanelle/Francis and Heber Valley) in the past 150 years.

Land-use and water development activities that contributed to the decline of this species on the Wasatch Front included urbanization, water development, agriculture, and livestock grazing, all of which have been ongoing on the Wasatch Front since the mid-1800s. What may be equally important are indirect and cumulative effects of such impacts as sedimentation, water quality contamination from agriculture or pollution, and competition or predation by nonnative species.

Widespread, but cursory, surveys for this species in the early 1990s revealed that nine populations remained but were likely threatened in light of little conservation awareness for the spotted frog, and the level of impacts on the populations and occupied habitat. In addition, this broad-ranging survey effort meant that all sites were not comprehensively surveyed, and because of the rarity of frogs and egg masses found, populations were estimated to be very small. For some populations, the cursory surveys may have accurately reflected the population size, but in other areas, populations were later found to be much larger and more extensive.

The Utah Natural Heritage Program database now summarizes that 18 different populations have been documented over the years through various sources. At the time of the Service's 1993 'warranted but precluded' finding for the spotted frog, 9 of the 18 had been extirpated. Also at the time, it was known that the Jordanelle Reservoir population would be destroyed and that no spotted frogs or egg masses had been documented at the Salamander Lake and Wallsburg sites since 1991. All three of these sites were extirpated or destroyed in subsequent years. Since that

time, no populations have been lost.

Current Status

There are seven extant populations of the spotted frog included in the Wasatch Front DPS, including the newly discovered Vernon population in the Rush Valley near the town of Vernon. Survey efforts since 1999 have greatly expanded the known range of most populations. Most notably, approximately 19 km (12 mi) of occupied spotted frog habitat were discovered along the upper Provo River corridor. All extant populations, with the exception of the very small, isolated Springville Hatchery/T-Bone Bottom population, have either increased (documented colonization of unoccupied newly created or restored sites) or have been found to be of a larger population size (additional occupied sites or greater density of sites found within known population boundaries) than previously thought (Table 12). In addition, the Vernon population was discovered in 2002.

Table 12. Numbers of Documented Breeding Sites in Spotted Frog Populations on the Wasatch Front.

Population	Year								
	1994	1995	1996	1997	1998	1999	2000	2001	2002
Jordanelle/Francis	14	14	14	14	14	23	23	33	48
Heber Valley	22	23	33	52	56	57	74	74	91
Springville Hatchery/ T-Bone Bottom	3	3	3	3	3	3	3	3	3
Burraston Ponds/ Mona Springs Complex	4	4	4	4	4	7	7	7	7
Holladay Springs	2	2	2	2	2	4	4	4	4
Fairview	11	11	11	11	11	13	26	26	26
Vernon									1

The Springville/T-Bone Bottom remains the most vulnerable to extirpation. However, the remaining population is located on protected land, as part of the Springville Hatchery, and efforts to minimize contaminant issues have been implemented. All other populations (Heber Valley, Jordanelle/Francis, Mona/Burraston, Holladay, and Fairview) have exhibited stable or increasing egg-mass trends based on a review of almost 10 years of egg-mass number data. Recent egg mass declines have occurred, but have been attributed to natural population dynamics resulting largely from climatic conditions, and not the result of changed landscape conditions (Krissy Wilson, UDWR, pers. comm., see Semlitsch 2002). These declines are not expected to continue for the long term; egg mass number fluctuation patterns have, in fact, been observed in all

populations since 1994. Based on this recent data (breeding sites and egg mass numbers), extant populations of the Wasatch Front spotted frog DPS, after decades of decline, can be to be stable to increasing, although egg mass numbers have been naturally fluctuating since 1994 (Table 13, Table 14).

Table 13. Number of Egg Masses at Documented Breeding Sites in Spotted Frog Populations on the Wasatch Front.

Population	Year								
	1994	1995	1996	1997	1998	1999	2000	2001	2002
Jordanelle/Francis	92	79	29	21	21	20 (63)	59 (99)	31 (165)	44 (260)
Heber Valley	120	156 (167)	323 (473)	219 (491)	176 (372)	206 (438)	151 (431)	123 (418)	206 (550)
Springville Hatchery/ T-Bone Bottom	7	6	0	65	87	44	50	25	9
Burraston Ponds/ Mona Springs Complex	5	66	63	148	78	61 (78)	111 (120)	69 (73)	41 (41)
Holladay Springs	24	33	29	64	122	144 (192)	135 (160)	52 (68)	27 (27)
Fairview	35	34	24	24	22	17 (25)	59 (130)	20 (163)	8* (86)
Vernon									4

(#) Includes number of egg masses original and recently discovered breeding sites.

* Three of 11 sites were not surveyed because access was denied to the property. This situation has been corrected and full access to these sites has been restored.

Table 14. Summary of Spotted Frog Population Trends.

Time Period	Number of Populations	Population Stability/Size
Pre-settlement	>18 ^a	no data
Early to Mid 1900s	18 ^a	presumed decreasing
up to 1993	9	documented decreased
1995 to 1998	6	stable
1998 to 2002	7 ^b	stable to increasing

^a Includes documented historic and current populations. Current populations are assumed to have been present historically.

^b Includes recently discovered Vernon population.

The recent change in species status and trends is due in part to our increased knowledge of the species distribution and in part due to the success of already-completed conservation efforts that have minimized or reduced many of the imminent threats to extant populations. Although not all actions necessary to alleviate concerns have been completed, completed conservation actions have addressed and removed or sufficiently reduced threats and the risk of extinction.

The development and implementation of the spotted frog Conservation Agreement represented an important shift in awareness and effort for conservation of the Wasatch Front spotted frog. Since the initiation of the Agreement in 1997-1998 and the subsequent conservation actions, monitoring and survey data has shown that populations are larger than previously thought.

Conservation actions have been successful at addressing localized threats to the species at the extant population areas (Appendix B). For example, habitat protection and removal of grazing at Mona Springs has resulted in significant improvements of spotted frog habitat. Habitat acquisitions specific for existing spotted frog populations have occurred (e.g., Heber Valley and Mona/Burraston) and significant acreages of unoccupied historic habitat have been purchased and protected (e.g., Utah Lake Wetland Preserve) as mitigation for prior impacts to aquatic resources associated with the Central Utah Project. Funds also have been allocated for research into the life history, habitat requirements, and genetics of the spotted frog.

Specific conservation actions and large-scale land acquisitions have occurred that may provide reintroduction areas for spotted frog range expansion efforts. For example, acquisition of the Utah Lake Wetland Preserve and parcels in the Weber River drainage to provide historical, but currently unoccupied habitats.

Population Viability

Of the extant populations, there is a range of ecological size and function that provides a level of diversity. Some populations occur along riparian wetland corridors while others occupy complex spring systems in the valley floor. Although populations are undoubtedly smaller than they were historically, most exhibit stable or increasing trends. The Heber Valley, Jordanelle/Francis, Fairview, and possibly the Mona/Burraston population are large enough to provide some small scale metapopulation function (genetic and demographic buffer) within individual population boundaries. Although not discrete populations, these locations occur over a geographic area of sufficient size and habitat diversity to yield localized genetic interchange. These sub-population dynamics provide local genetic and demographic buffer for the overall population. Other populations like the Springville and Holladay populations, provide small, isolated genetic and demographic refuge and a locally unique ecological function to the Wasatch Front DPS.

There is no specific answer in conservation literature as to the number of populations necessary to allow long-term persistence of a species in a natural evolutionary trajectory. For amphibians, most experts agree metapopulation dynamics provide a critical role in population stability. In the absence of large, connected metapopulations, multiple spotted frog populations of different

sizes that represent a range of natural ecological function can provide a reasonable level of assurance for long-term persistence of the species. Newly created or isolated small populations can provide demographic and genetic refuge for other populations. Larger, better connected populations can prevent loss of genetic diversity and prevent detrimental genetic effects that can occur in small populations.

The number of extant populations is one factor affecting the viability of a species. The greater number of populations that occur, the less likely the species will go extinct. This also can be misleading. One large metapopulation fragmented into two smaller populations by human impacts does not translate into a greater chance of persistence. Other factors, such as population size (relative density, abundance or effective size) and stability (protection of habitat, stable or increasing trend in monitoring data) must be considered in concert with number of populations. When there is a positive or stable trend in population size and numbers and a reduction in threats due to completed and ongoing conservation actions, the species is likely to persist into the future.

Summary

The overall level of threats to the long-term persistence of the Wasatch Front spotted frog has decreased in recent years, particularly since 1998. Although most of the human activities that contributed to these threats still occur to some extent throughout the Wasatch Front, there is no longer the same level of impacts on the spotted frog that resulted in past wide-spread habitat destruction and the loss of spotted frog populations. Much of the occupied habitat for the spotted frog is under State or Federal ownership and ongoing management of these lands emphasizes the long-term persistence of the spotted frog. This is not to say that threats have been eliminated. Localized areas continue to be affected by specific problem activities.

However, mechanisms are in place through Federal, State, and local conservation and land-use plans to identify these activities, correct the problems, and protect spotted frog populations. To date, these actions have been successful at reducing threats to extant populations, largely by acquiring important habitats and implementing management actions that improve habitat conditions. Success is evidenced by the stable to improving status of the spotted frog throughout the Wasatch Front in the most recent time period evaluated.

Based on this analysis of the effects of conservation actions already in place, the trajectory of the Wasatch Front spotted frog status is toward more secure populations, reduced threats, and improved habitat conditions. Although some current and future potential threats continue and may increase, most threats have been or are being addressed through completed or ongoing actions and at this time do not threaten the long-term persistence of the spotted frog. Our analysis of the five factors under section 4(a)(1) of the Act, individually and collectively, indicates that the spotted frog is not in danger of extinction or likely to become in danger of extinction in the foreseeable future throughout all or a significant portion of the Wasatch Front. Therefore, the Service finds that the Wasatch Front spotted frog is “not warranted” for listing under the Act. If new information indicating that the level of threats have become more severe or the status of the spotted frog or its habitat degenerates in the future, the status of the spotted

frog will be reevaluated.

Recommendations for the Future

Following historical habitat and population losses, the current populations are stable to improving and most are protected to a large degree from ongoing direct habitat loss, due to already completed conservation actions. Further habitat acquisitions and protections are in progress for the Jordanelle/Francis, Heber Valley, Mona/Burraston, and Fairview populations. Current ventures are focused on acquiring habitat easements along approximately 9.7 kilometers (6 miles) above Jordanelle Dam, including occupied and suitable spotted frog habitats. Easements are currently being pursued with seven Fairview landowners to protect approximately 162 hectares (400 acres) of occupied spotted frog habitat and migration corridors from potential water and residential development. The remaining 15 percent of the Provo River corridor in the Heber Valley is projected to be purchased and protected by 2004. In the Mona/Burraston population, fee-title purchase or conservation easements are currently being negotiated for 7.9 hectares (19.5 acres) which would allow for protection of all spring and potential spotted frog habitat on this site. Therefore, the focus of spotted frog conservation efforts can reasonably shift to acquisition of additional occupied and unoccupied, suitable habitats and range expansion efforts, including:

- (1) Land protection mechanisms, such as conservation easements and fee-title acquisitions generally provide the most long-term benefits for sensitive species. Voluntary conservation actions on parcels of private land may provide site-specific benefits to the frog. Future conservation should continue to focus on land acquisition and easements that include buffer zones sufficient to minimize direct and indirect impacts from land use as well as protection and maintenance of dispersal or migration corridors. Furthermore, steps should be taken to protect water sources (i.e., Juab Valley) where potential threats are identified.
- (2) Although there is no specific number of populations necessary to prevent extinction, reintroduced populations provide ecological redundancy in ecological function and genetic and demographic stochasticity. There are several habitats already identified which may provide suitable reintroduction sites. Future conservation should include reestablishment of spotted frog populations, and associated research and land management necessary to maintain new populations in: (1) areas where populations previously occurred if suitable habitat remains and (2) other suitable habitat within the natural range of the species.
- (3) Some Wasatch Front spotted frog populations are notably small in size and vulnerable to risks of detrimental genetic processes (inbreeding, loss of genetic diversity) and demographic uncertainty. Springville Hatchery/T-Bone Bottom population is particularly vulnerable based on its current size and decreasing trend. Actions should be taken to augment or through some other process, increase the size of this population. Furthermore, the current trend should be evaluated to determine if specific land or water use activities are exacerbating the decrease. If specific threats are identified, priority should be placed on reducing these threats such that the population would remain secure into the future.

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APPENDIX A: Figures

APPENDIX B:
**Conservation Actions for the Wasatch Front Columbia Spotted Frog,
Implemented Since 1998**

**TABLE 1.
SUMMARY OF SURVEY ACTIONS FOR WASATCH FRONT COLUMBIA SPOTTED FROG IMPLEMENTED SINCE 1998**

GMU	SUBUNIT	REQUIRED ACTIONS	IMPLEMENTED ACTIONS	RESULTS
Wasatch Front	Utah Lake	Identify suitable habitat. Survey suitable habitat. Identify areas for reintroduction. Re-survey historic localities.	Sweep surveys of 0.4 sq. km west and south of Mona spring complex (1999). Sweep surveys of 9.6 sq km south of Burraston ponds (1999). Sweep surveys of American Fork Canyon (2002). Sweep surveys of Cascade Springs Scenic Drive (2002). Sweep surveys of South Fork of Provo River (2002). Sweep surveys of the Vivian Park area (2002).	No spotted frogs, tadpoles, or egg masses were observed. Unoccupied, suitable habitat was identified. 17 spotted frog egg masses were observed at 4 previously unknown breeding sites. Unoccupied, suitable habitat was identified. No spotted frogs, tadpoles, or egg masses were observed. Unoccupied, suitable habitat was identified. No spotted frogs, tadpoles, or egg masses were observed. Unoccupied, suitable habitat was identified. No spotted frogs, tadpoles, or egg masses were observed. Unoccupied, suitable habitat was identified. No spotted frogs, tadpoles, or egg masses were observed. Unoccupied, suitable habitat was identified.
	Spanish Fork River	Identify suitable habitat. Survey suitable habitat. Identify areas for reintroduction. Re-survey historic localities.	Sweep surveys of 4.8 sq. km surrounding the Holladay Spring monitoring site (1999).	48 spotted frog egg masses were observed at 2 previously unknown breeding site. Other, unoccupied, suitable habitat was identified.
	Provo River	Identify suitable habitat. Survey suitable habitat. Identify areas for reintroduction. Re-survey historic localities.	Sweep surveys of 6.4 sq. km from Spring Lake to the mountain foothills (1999). Sweep surveys of 40 sq. km from Indianola, through Thistle Creek Valley to confluence of Thistle Creek and Spanish Fork River. Surveys of all wetland/spring/beaver complex habitats from Jordanelle Reservoir upstream along approximately 12 miles of the Provo River corridor (1999-2002). Annual sweep surveys of all wetlands along the Provo River corridor in Heber Valley (1997-2002).	No spotted frogs, tadpoles, or egg masses were observed. Unoccupied, suitable habitat was identified. No spotted frogs, tadpoles, or egg masses were observed. Unoccupied, suitable habitat was identified. 34 previously unknown breeding sites were discovered. 216 egg masses were observed at these additional sites in 2002. 54 previously unknown breeding sites were identified. 272 egg masses were observed at these additional sites in 2002.
	Upper Weber River	Identify suitable habitat. Survey suitable habitat. Identify areas for reintroduction. Re-survey historic localities.	8 surveys at ponds 0.9-1.8 miles south of Alt. 189 (historic locality) (1998). 7 surveys at ponds east of 1000 East, north of Provo River (historic locality) (1998).	No spotted frogs, tadpoles, or egg masses were observed. No spotted frogs, tadpoles, or egg masses were observed.

GMU	SUBUNIT	REQUIRED ACTIONS	IMPLEMENTED ACTIONS	RESULTS
			<p>3 surveys at ponds and canal north of Wanship near Weber River (1998).</p> <p>3 surveys at ponds below Echo Dam (historic locality) (1998).</p> <p>Sweep survey along approximately 1 mile of upper Weber River between Echo and Rockport Reservoirs (historic locality) (2002).</p> <p>10 surveys at beaver ponds along Beaver Creek (1998, 2001).</p> <p>1 survey at spring/pond in Brown's Canyon (1998).</p> <p>2 surveys at private pond in Kamas Valley (1998).</p> <p>1 survey at stock pond (1998).</p> <p>3 surveys on Chalk Creek and tributaries (1999).</p>	<p>No spotted frogs, tadpoles, or egg masses were observed.</p> <p>No spotted frogs, tadpoles, or egg masses were observed.</p> <p>No spotted frogs, tadpoles, or egg masses were observed.</p> <p>No spotted frogs, tadpoles, or egg masses were observed.</p> <p>No spotted frogs, tadpoles, or egg masses were observed.</p> <p>No spotted frogs, tadpoles, or egg masses were observed.</p> <p>No spotted frogs, tadpoles, or egg masses were observed.</p> <p>No spotted frogs, tadpoles, or egg masses were observed.</p>
	Lower Weber River	<p>Identify suitable habitat.</p> <p>Survey suitable habitat.</p> <p>Identify areas for reintroduction.</p> <p>Re-survey historic localities.</p>	<p>1 survey at temporary pond south of 2700 N in Farr West (1998).</p> <p>1 survey at marsh near Riverdale City Hall (Thompson 1998).</p> <p>3 surveys at marshes near Weber River (1998).</p> <p>4 surveys at pond near Hardware Ranch Road and Route 39 (historic locality) (1998, 1999).</p> <p>Annual surveys of lower and upper Farmington lakes and surrounding wetlands (historic locality) (1998-2002).</p> <p>3 surveys in wetlands along lower Weber River (2002).</p>	<p>No spotted frogs, tadpoles, or egg masses were observed.</p> <p>No spotted frogs, tadpoles, or egg masses were observed.</p> <p>No spotted frogs, tadpoles, or egg masses were observed.</p> <p>No spotted frogs, tadpoles, or egg masses were observed.</p> <p>No spotted frogs, tadpoles, or egg masses were observed.</p>
	Jordan River	<p>Identify suitable habitat.</p> <p>Survey suitable habitat.</p> <p>Identify areas for reintroduction.</p> <p>Re-survey historic localities.</p>	<p>No surveys were conducted--considered a low priority due to lack of potential habitat and negligible chance of finding a spotted frog population.</p>	<p>None.</p>

GMU	SUBUNIT	REQUIRED ACTIONS	IMPLEMENTED ACTIONS	RESULTS
Sevier River	San Pitch River	Identify suitable habitat. Survey suitable habitat. Identify areas for reintroduction.	Sweep surveys of 2.0 sq. km surrounding standard monitoring sites (1999); sweep surveys of 81.6 sq. km between Mt. Pleasant and Milburn (2000). Sweep surveys of 30 km ² southwest of Mt. Pleasant to Gunnison Reservoir (2001). Sweep surveys of all suitable habitat in Mills Valley (~12 km ²) (2000).	Spotted frog egg masses were observed at 2 previously unknown breeding sites. Spotted frog egg masses were observed at 13 previously unknown breeding sites. 78 egg masses were observed at these 15 additional sites in 2002. No spotted frogs, tadpoles, or egg masses were observed.
	Lower Sevier River	Identify suitable habitat. Survey suitable habitat. Identify areas for reintroduction.		No spotted frogs, tadpoles, or egg masses were observed.
	Middle Sevier River	Identify suitable habitat. Survey suitable habitat. Identify areas for reintroduction.	No surveys were conducted--considered a low priority due to lack of historic records.	None.
West Desert	Tooele Valley	Identify suitable habitat. Survey suitable habitat. Identify areas for reintroduction. Re-survey historic localities.	Survey of wetlands in Rush Valley near Vernon (2002).	Discovered a new spotted frog population; in West Desert GMU, but geographically closer to Wasatch Front populations. 4 egg masses were observed at this site in 2002.

**TABLE 2.
SUMMARY OF HABITAT ACQUISITION AND ENHANCEMENT ACTIONS FOR WASATCH FRONT COLUMBIA SPOTTED FROG
IMPLEMENTED SINCE 1998**

GMU	SUBUNIT	REQUIRED ACTIONS	IMPLEMENTED ACTIONS	RESULTS
Wasatch Front	Utah Lake	<p>Identify and prioritize areas of public and private lands available for land or water acquisition or conservation easements.</p> <p>Acquire or protect priority areas through easements where feasible.</p> <p>Identify areas that have been degraded and require enhancement.</p> <p>Implement enhancement projects that include wetland improvements, water restoration, water quality improvements, bank stabilization, and construction of livestock exclosures.</p>	<p>Acquired 85.5 acres containing a portion of the Mona spring complex (1998).</p> <p>Ongoing negotiations for the acquisition of 20 additional acres containing the remaining, unprotected portion of the Mona spring complex (1999-2002).</p> <p>Developed Mona Springs Operating Agreement (1999).</p> <p>Repaired fence surrounding Mona property (2000).</p> <p>Constructed electric fence around spring complex on Mona property (2000).</p> <p>Removed cow carcasses and manure from area of Mona property surrounded by electric fence (2000).</p> <p>Replaced gate, installed crossing stile (2001, 2002).</p> <p>Developed the Mona Spring Complex Habitat Management Plan (draft, 2001).</p>	<p>Prevents destruction or degradation of spotted frog habitat due to human development.</p> <p>Limits amount and duration of livestock grazing until 2003. Prohibits livestock grazing in 2003.</p> <p>Will allow UDWR to protect and enhance habitat throughout the entire spring complex.</p> <p>Facilitated title transfer from URMCC to UDWR. Outlined objectives for habitat improvement, public use, and monitoring and evaluation.</p> <p>Prevents livestock access outside of permitted grazing period (May-November until 2003).</p> <p>Prevents livestock access to spotted frog habitat during permitted grazing period (May-November until 2003). Improved bank condition. Restored riparian vegetation.</p> <p>Improved water quality. Prevents spotted frog, tadpole, and egg mass mortality due to livestock trampling.</p> <p>Removed excess nutrients, improved water quality.</p> <p>Prevents livestock access outside of permitted grazing period. Allows public access.</p> <p>Implementation of the plan, beginning in 2002, will improve and create more spotted frog habitat by adding habitat structure, reducing bank slope, increasing canopy cover and vegetation, and dredging springheads.</p>

GMU	SUBUNIT	REQUIRED ACTIONS	IMPLEMENTED ACTIONS	RESULTS
	Spanish Fork River	<p>Identify and prioritize areas of public and private lands available for land or water acquisition or conservation easements.</p> <p>Acquire or protect priority areas through easements where feasible.</p> <p>Identify areas that have been degraded and require enhancement.</p> <p>Implement enhancement projects that include wetland improvements, water restoration, water quality improvements, bank stabilization, and construction of livestock exclosures.</p>	<p>Acquired 9,530 acres for the Utah Lake Wetland Preserve (1998-2002).</p> <p>Initiated development of a Spanish Fork River Subunit Habitat Management Plan; Completed actions include distribution surveys, habitat identification and characterization, and initial landowner contacts (2001-2002).</p>	<p>Prevents destruction or degradation of potential spotted frog habitat due to human development. Provides secure habitats for potential reintroduction.</p> <p>Plan will outline actions to protect and improve spotted frog habitat through conservation easements and agreements with private landowners.</p>
	Provo River	<p>Identify and prioritize areas of public and private lands available for land or water acquisition or conservation easements.</p> <p>Acquire or protect priority areas through easements where feasible.</p> <p>Identify areas that have been degraded and require enhancement.</p> <p>Implement enhancement projects that include wetland improvements, water restoration, water quality improvements, bank stabilization, and construction of livestock exclosures.</p>	<p>Acquired 621 acres of riparian/wetland habitat along the Provo River corridor between Jordanelle Reservoir and Deer Creek Reservoir (1998-2002).</p> <p>Created 60-70 new wetlands according to spotted frog suitability criteria and improved several existing wetlands along the Provo River corridor between Jordanelle Dam and Deer Creek Reservoir (1999-2002).</p> <p>Removed culvert on the Cottonwood Canyon access road; replaced with a concrete span bridge to allow beaver activity (1999).</p> <p>Provided perennial flow to the Provo River corridor, including the 3 largest BOR mitigation wetlands (1999-2002). Acquired flows include 125 cfs (CUP minimum stream flows) and 650 ac-ft of water rights.</p> <p>Raised groundwater table in Provo River corridor through riverbed restoration (1999-2002).</p>	<p>Prevents destruction or degradation of spotted frog habitat due to human development.</p> <p>Increased the amount of suitable spotted frog habitat in Heber Valley.</p> <p>Prevents detrimental water level fluctuations in spotted frog breeding habitats due to blocking by beaver dams.</p> <p>Improved suitability of the 3 BOR mitigation wetlands used most frequently for spotted frog breeding. Prevents wetland drying and concomitant desiccation of egg masses and tadpoles in the Provo River corridor.</p> <p>Improves perennial water supply in floodplain wetlands. Prevents wetland drying and concomitant desiccation of egg masses and tadpoles.</p>

GMU	SUBUNIT	REQUIRED ACTIONS	IMPLEMENTED ACTIONS	RESULTS
			<p>Modified or eliminated detrimental land use practices (livestock grazing, agriculture, beaver dam removal) on property acquired along Provo River corridor (1999-2002).</p> <p>Initiated negotiations for a conservation easement to protect breeding habitat along the Provo River corridor near Woodland.</p> <p>Developing a plan with consulting firm and resource agencies to minimize impacts associated with the proposed Victory Ranch development, and to enhance an create habitat, and develop conservation easements.</p> <p>Acquired approximately 2 miles of the upper Weber River and associated wetlands; conducted habitat improvement projects including the construction of stabilization weirs and planting of willows and other native vegetation.</p>	<p>Reduces water quality degradation associated with pesticide application. Reduces water quality degradation associated with livestock grazing. Improves bank condition and restores riparian vegetation. Prevents spotted frog mortality due to livestock trampling. Prevents loss of habitat associated with beaver dam removal. Approximately 40 new wetlands were created by beaver activity.</p> <p>Conservation easement will prevent destruction or degradation of approximately 16.8 ac of spotted frog habitat due to human development.</p> <p>Will protect, improve, and create approximately 5 mi of spotted frog habitat.</p> <p>Prevents destruction or degradation of potential spotted frog habitat due to human development. Stabilized and improved the stream corridor and potential spotted frog habitat. Provides secure habitats for potential reintroduction.</p>
	Upper Weber River	<p>Identify and prioritize areas of public and private lands available for land or water acquisition or conservation easements.</p> <p>Acquire or protect priority areas through easements where feasible.</p> <p>Identify areas that have been degraded and require enhancement.</p> <p>Implement enhancement projects that include wetland improvements, water restoration, water quality improvements, bank stabilization, and construction of livestock exclosures.</p>		

GMU	SUBUNIT	REQUIRED ACTIONS	IMPLEMENTED ACTIONS	RESULTS
	Lower Weber River	Identify and prioritize areas of public and private lands available for land or water acquisition or conservation easements. Acquire or protect priority areas through easements where feasible. Identify areas that have been degraded and require enhancement. Implement enhancement projects that include wetland improvements, water restoration, water quality improvements, bank stabilization, and construction of livestock exclosures.	Conducted habitat improvement projects in approximately 8 miles of the lower Weber River including construction of stabilization weirs and planting of willows and other native vegetation.	Limits bank erosion and improves riparian conditions.
	Jordan River	Identify and prioritize areas of public and private lands available for land or water acquisition or conservation easements. Acquire or protect priority areas through easements where feasible. Identify areas that have been degraded and require enhancement. Implement enhancement projects that include wetland improvements, water restoration, water quality improvements, bank stabilization, and construction of livestock exclosures.	No habitat protection or enhancement was conducted - considered a low priority because no documented spotted frog populations occur in the subunit and minimal suitable habitat exists.	None.
Sevier River	San Pitch River	Identify and prioritize areas of public and private lands available for land or water acquisition or conservation easements. Acquire or protect priority areas through easements where feasible. Identify areas that have been degraded and require enhancement. Implement enhancement projects that include wetland improvements, water restoration, water quality improvements, bank stabilization, and livestock exclosures.	Completed San Pitch River Subunit Habitat Management Plan (2001). Secured approximately \$277,000 and initiated negotiations with private landowners for the purchase of conservation easements (2001-2002).	Identifies actions for habitat protection and enhancement including purchasing conservation easements for private property, restricting grazing, adding habitat structure, reducing bank slope, increasing vegetation, and dredging springheads. Conservation easements will prevent destruction or degradation of spotted frog habitat due to residential development, agricultural practices, and livestock grazing..
	Lower Sevier River	None.	No habitat protection or enhancement was conducted - considered a low priority because no documented spotted frog populations occur in the subunit.	None.

GMU	SUBUNIT	REQUIRED ACTIONS	IMPLEMENTED ACTIONS	RESULTS
	Middle Sevier River	None.	No habitat protection or enhancement was conducted -considered a low priority because no documented spotted frog populations occur in the subunit.	None.

**TABLE 3.
SUMMARY OF NONNATIVE SPECIES CONTROL ACTIONS FOR WASATCH FRONT COLUMBIA SPOTTED FROG
IMPLEMENTED SINCE 1998**

GMU	SUBUNIT	REQUIRED ACTIONS	IMPLEMENTED ACTIONS	RESULTS
Wasatch Front	Utah Lake	Determine where detrimental nonnative species interactions occur. Eradicate or control detrimental nonnative fish where feasible.	Identified threat of egg and tadpole predation by mosquitofish and other nonnative fishes in the Mona spring complex. Conducted 3 nonnative fish removal projects at the Mona spring complex (1999-2001).	Determined need to control nonnative fishes in the spring complex. Removed an estimated 90% of the mosquitofish population from spotted frog habitat. Nonnative fish numbers were reduced during spotted frog breeding season, but rebounded to original levels within 12 months of each removal project.
	Spanish Fork River	Determine where detrimental nonnative species interactions occur. Eradicate or control detrimental nonnative fish where feasible.	Mosquitofish and trout were identified in or near spotted frog breeding habitats.	Will be addressed during development of the Spanish Fork River Subunit Habitat Management Plan.
	Provo River	Determine where detrimental nonnative species interactions occur. Eradicate or control detrimental nonnative fish where feasible.	Documented predation on spotted frogs by raccoons in the Provo River corridor. Observed predation on spotted frogs by brown trout in the Provo River.	Determined need to assess impact of raccoon predation and options for control. Determined need to assess spotted frog use of the Provo River.
	Upper Weber River	Determine where detrimental nonnative species interactions occur. Eradicate or control detrimental nonnative fish where feasible.	Detrimental interactions have not been identified and control projects have not been implemented because there are no documented spotted frog populations in this subunit.	None.
	Lower Weber River	Determine where detrimental nonnative species interactions occur. Eradicate or control detrimental nonnative fish where feasible.	Detrimental interactions have not been identified and control projects have not been implemented because there are no documented spotted frog populations in this subunit.	None.

GMU	SUBUNIT	REQUIRED ACTIONS	IMPLEMENTED ACTIONS	RESULTS
	Jordan River	Determine where detrimental nonnative species interactions occur. Eradicate or control detrimental nonnative fish where feasible.	Detrimental interactions have not been identified and control projects have not been implemented because there are no documented spotted frog populations in this subunit.	None.
Sevier River	San Pitch River	Determine where detrimental nonnative species interactions occur. Eradicate or control detrimental nonnative fish where feasible.	Identified presence of carp, brown trout, brook trout, and raccoons in and near several wetlands. Completed the San Pitch River Subunit Habitat Management Plan (1999-2001).	Determined need to assess impacts and options for control. Identified where actions are necessary to control carp, brown trout, and brook trout in several wetlands. Implementation of plan will reduce threat of predation and improve water quality in some areas.
	Lower Sevier River	Determine where detrimental nonnative species interactions occur. Eradicate or control detrimental nonnative fish where feasible.	Detrimental interactions have not been identified and control projects have not been implemented because there are no documented spotted frog populations in this subunit.	None.
	Middle Sevier River	Determine where detrimental nonnative species interactions occur. Eradicate or control detrimental nonnative fish where feasible.	Detrimental interactions have not been identified and control projects have not been implemented because there are no documented spotted frog populations in this subunit.	None.
Statewide		Future stocking of nonnative aquatic species will be consistent with the State of Utah Policy on Fish Stocking and Transfer Procedures. Control or modify stocking, introductions, and spread of nonnative aquatic species where appropriate. Establish protocols for eradication of nonnative species. These protocols should be developed that will minimize impacts of eradication on the native species community.	Followed the State of Utah Policy on Fish Stocking and Transfer Procedures (1998-2002). Developing MOU with Mosquito Abatement Districts (2002). Developed and assessed protocols for nonnative species control at the Mona spring complex (2000-2002).	Prevented stocking of potentially harmful species into frog habitat. Prevented transmission of pathogens. Restricts areas where mosquitofish may be stocked. Prevents introduction of mosquitofish into spotted frog habitats. Mechanical removal was attempted and is currently being evaluated.

TABLE 4.

SUMMARY OF RANGE EXPANSION ACTIONS FOR WASATCH FRONT COLUMBIA SPOTTED FROG IMPLEMENTED SINCE 1998

GMU	SUBUNIT	REQUIRED ACTIONS	IMPLEMENTED ACTIONS	RESULTS
Wasatch Front	Utah Lake	Identify brood stock and augmentation needs. Develop brood stocks when necessary. Augment populations when necessary.	Developed the Mona Springs Habitat Management Plan (draft; 2001).	Identifies actions for population augmentation through a “headstarting” program.
			Quantified levels of within population genetic variability and assessed genetic divergence from all other spotted frog populations in Utah (1999, 2000).	Provided information to identify brood stock and augmentation needs.
	Spanish Fork River	Identify brood stock and augmentation needs. Develop brood stocks when necessary. Augment populations when necessary.	Quantified levels of within population genetic variability and assessed genetic divergence from all other spotted frog populations in Utah.	Provided information to identify brood stock and augmentation needs.
			Created 60-70 wetlands according to spotted frog suitability criteria and improved several wetlands along the Provo River corridor between Jordanelle and Deer Creek Reservoirs (1999-2002).	Spotted frogs have colonized approximately 40 of the newly created or improved wetlands; breeding was documented in 15. 2002 data suggest that expansion into newly protected and restored habitats is ongoing. Spotted frog distribution in Heber Valley has expanded.
	Provo River	Identify brood stock and augmentation needs. Develop brood stocks when necessary. Augment populations when necessary.	Translocated egg masses into an unoccupied area along the Provo River corridor (2000).	Established a reproducing subpopulation in a new area of Heber Valley.
			Translocated adult spotted frogs into an unoccupied area along the Provo River corridor (2000).	Adult frogs were not observed after release, and translocation was considered to be unsuccessful.
	Upper Weber River	Identify brood stock and augmentation needs. Develop brood stocks when necessary. Augment populations when necessary.	Quantified levels of within population genetic variability and assessed genetic divergence from all other spotted frog populations in Utah (1999, 2000).	Provided information to identify brood stock and augmentation needs.
			Unless extant populations are discovered within the subunit, any brood stock will be developed from populations in adjacent, occupied subunits.	
	Lower Weber River	Identify brood stock and augmentation needs. Develop brood stocks when necessary. Augment populations when necessary.	Unless extant populations are discovered within the subunit, any brood stock will be developed from populations in adjacent, occupied subunits.	
			Unless extant populations are discovered within the subunit, any brood stock will be developed from populations in adjacent, occupied subunits.	
Jordan River	Identify brood stock and augmentation needs. Develop brood stocks when necessary. Augment populations when necessary.	Unless extant populations are discovered within the subunit, any brood stock will be developed from populations in adjacent, occupied subunits.		

GMU	SUBUNIT	REQUIRED ACTIONS	IMPLEMENTED ACTIONS	RESULTS
Sevier River	San Pitch River	Identify brood stock and augmentation needs. Develop brood stocks when necessary. Augment populations when necessary.	Completed the San Pitch River Subunit Habitat Management Plan (2001).	Identifies actions for population augmentation through a "headstarting" program.
			Quantified levels of within population genetic variability and assessed genetic divergence from all other spotted frog populations in Utah (1999, 2000).	Provided information to identify brood stock and augmentation needs.
	Lower Sevier River	None.	Unless extant populations are discovered within the subunit, any brood stock will be developed from populations in adjacent, occupied subunits.	
	Middle Sevier River	None.	Unless extant populations are discovered within the subunit, any brood stock will be developed from populations in adjacent, occupied subunits.	

GMU	SUBUNIT	REQUIRED ACTIONS	IMPLEMENTED ACTIONS	RESULTS
Statewide		<p>Determine feasibility and methodologies for augmentation and reintroduction.</p> <p>Develop protocols for the captive propagation and rearing of spotted frog.</p> <p>Develop protocols for the translocation, introduction, and reintroduction for spotted frog.</p> <p>Identify and develop brood stock sources including identification and taking of wild sources, and potential rearing facilities.</p> <p>Augment population through stocking that have become small enough that genetic viability may be threatened.</p> <p>Establish additional populations through reintroduction and introductions.</p> <p>Maintain consistency with the State of Utah Policy on Fish Stocking and Transfer Procedures and with the Least Chub Conservation Agreement and Strategy.</p>	<p>Published a Revised Hatchery Production Plan (1998).</p> <p>Completed siting study for warm water hatchery with facilities for spotted frog propagation (1999).</p> <p>Initiated NEPA process for warm water hatchery with facilities for spotted frog propagation (2000-2002).</p> <p>Conducted literature review of amphibian “headstarting” augmentation programs.</p> <p>Conducted experimental translocations of egg masses and adults into an unoccupied area along the Provo River to test reintroduction methodologies.</p> <p>Quantified levels of within and among population genetic variability for all spotted frog populations in Utah (1999, 2000).</p>	<p>Identifies amphibian production needs for 1996-2035.</p> <p>Recommended site is Gandy Warm Springs.</p> <p>Will meet NEPA requirements.</p> <p>Evaluated success of previous programs and assessed applicability for spotted frog.</p> <p>Translocated egg masses matured into reproducing adults, and the translocation was considered to be successful.</p> <p>Translocated adults were not observed after release, and the translocation was considered to be unsuccessful.</p> <p>Provided information to identify brood stock and augmentation needs.</p>

**TABLE 5.
SUMMARY OF MONITORING ACTIONS FOR WASATCH FRONT COLUMBIA SPOTTED FROG**

GMU	SUBUNIT	REQUIRED ACTIONS	IMPLEMENTED ACTIONS	RESULTS
Wasatch Front	Utah Lake	Implement statewide monitoring program.	Monitored standard monitoring sites annually since 1992.	Quantified number of egg masses deposited each year.
	Spanish Fork River	Implement statewide monitoring program.	Monitored additional breeding sites annually since discovery in 1999.	Quantified number of egg masses deposited each year.
	Provo River	Implement statewide monitoring program.	Monitored standard monitoring sites annually since 1992.	Quantified number of egg masses deposited each year.
	Upper Weber River	None.	Monitored egg masses throughout Heber Valley since 1996.	Quantified number of egg masses deposited each year.
	Lower Weber River	None.	None - There are no documented populations in this subunit.	None.
	Jordan River	None.	None - There are no documented populations in this subunit.	None.
	San Pitch River	Implement statewide monitoring program.	Monitored standard monitoring sites annually since 1992.	Quantified number of egg masses deposited each year.
	Lower Sevier River	None.	Monitored additional breeding sites annually since discovery in 1999.	Quantified number of egg masses deposited each year.
	Middle Sevier River	None.	None - There are no documented populations in this subunit.	None.
Sevier River				

**TABLE 6.
SUMMARY OF GENETIC ANALYSIS AND RESEARCH ACTIONS FOR WASATCH FRONT COLUMBIA SPOTTED FROG
IMPLEMENTED SINCE 1998**

ACTION CATEGORY	REQUIRED ACTIONS	IMPLEMENTED ACTIONS
Genetic Analysis	<p>Conduct genetic analysis of all known spotted frog populations. Establish introduction, reintroduction, and transplant protocols based on criteria of maintaining genetic integrity and maximizing genetic variability.</p>	<p>Conducted analysis of within and among population genetic variability for all known Utah spotted frog populations (1997-1999).</p> <p>Conducted a phylogeographic study of spotted frog populations in Washington, Oregon, Idaho, Montana, Wyoming, Nevada, and Utah; Determined that the Utah populations comprise 2 clades that are candidate Evolutionary Significant Units: the Bonneville clade and the Deep Creek clade (2000).</p>
Research	<p>Conduct studies to determine:</p> <ol style="list-style-type: none"> 1. year round life stage habitat use; 2. wetland/spring condition and water quality requirements; 3. flow quantity, flow timing, flow duration, water level requirements; 4. sympatry of macro/microinvertebrate composition and ecology; 5. effects of chemical toxins released in the environment. <p>Determine the number of individuals needed to maintain a viable population.</p>	<p>Conducted mark/recapture study of adult frogs in a 3 mile reach along the Provo River corridor to track movement among wetlands and to obtain estimates of adult population size (1997-2002).</p> <p>Conducted timed visual encounter survey in pre-existing and newly created wetlands to assess encounter rates as a measure of relative spotted frog abundance.</p> <p>Characterized spotted frog use of wetlands for breeding in Heber Valley according to permanence, hydrology, and wetland type.</p> <p>Determined habitat associations of spotted frog throughout Utah; analysis included habitat parameters, water quality, and faunal composition.</p> <p>Determined feasibility of using radio telemetry to determine winter behavior and habitat use in Heber Valley.</p> <p>Conducted a study to determine if spotted frogs can be identified by individual spotting patterns. Results suggest that spotting patterns remain consistent throughout lifetime and photographs could be used to identify individual frogs in the wild.</p> <p>Conducted an experimental translocation of egg masses and adult spotted frogs into an unoccupied area in Heber Valley. The egg mass translocation was successful and the adult translocation appears to be unsuccessful.</p> <p>Initiated planning for a Conservation Objectives Workshop that will help determine levels of viability.</p>